SCIENCE.

FRIDAY, MARCH 21, 1884.

COMMENT AND CRITICISM.

THE work of the census has again, and for the third time, come to a stop for lack of money. This time the suspension is more serious than ever, the working-force being reduced to the chief clerk, who is also acting superintendent, and an assistant. The public printer has been notified to stop printing the reports; and, unless some extraordinary step is taken, the whole work of the bureau for four months to come will be confined to opening the daily mail. Several volumes of the final report have been published, and have been received with unqualified satisfaction, both here and in Europe; demonstrating, as they do, that this census is the most complete and the best organized ever yet attempted by any nation. The remaining fifteen or twenty volumes are understood to be ready for printing. The causes of delay are two, — the modesty of the superintendent in his requests to Congress for money, and the overcrowded state of the government printing-office. Surely Congress will not refuse to make apropriations of the most liberal dimensions to carry on this work, and to secure the printing of the reports before they have lost part of their interest through age. Let the demand be for a quarter of a million, if necessary; and let the office staff be increased in efficiency by the appointment of a special staff of experienced editors, who shall aid the superintendent in bringing the publication to an early termination.

THE fourth number, for March, of the pilot chart of the North Atlantic Ocean, issued by the Hydrographic office, differs from the earlier sheets of the series, notably in the number of icebergs reported for February south-east of Newfoundland. An aberrant berg appears about three hundred miles west-south-west of Ireland, in latitude 51°, longitude 18° west. In the legend concerning the weather reported for February, we are glad to see the term 'straight-line gale' of the previous charts reduced to the more non-committal 'gale;' but the absence of 'cyclones' is still insisted upon. Whatever be the meaning attached to this word by mariners, its ordinary use to include all large rotary storms, whether from within the tropics or not, is now so general and so proper, that the repeated statement, 'no cyclones are reported' for the winter months of the stormy North Atlantic, surely needs qualification. The intention is, no doubt, to state that no *tropical* cyclones have come up along our coast from the West Indies: if so, it should be more explicitly worded.

The compilation of observations on wrecks and abandoned vessels promises valuable results for the determination of currents. In only four months' records, over sixty examples are given, in many cases identified by name, and in a few cases reported by two or more observers on different dates. When the wrecks are floating almost awash, presenting little surface for the wind to blow upon, they will move only with the surface-drift, and, as noted in sucessive positions, will give excellent data for measuring the direction and velocity of currents. By thus keeping track of their movements, it will be possible to avoid the error of the old-fashioned bottle-experiments, in which only the beginning and end of the course were determinable, and time of passage was unknown. At the end of the year we shall hope to present a *résumé* of the results thus attained.

THE various local sub-committees of the British association at Montreal seem to be pushing the work in their special subjects with an energy which promises much for a successful meeting in August. In the section of economics especially, the committee is taking advantage of the opportunity presented, by bringing

forward papers which will give a comprehensive survey of the various important economical questions which are just now exciting so much discussion with reference to the future growth and prosperity of the colony. Among these, agriculture necessarily occupies a prominent position; but it is gratifying to see that general and technical education is also to receive important consideration.

Our leading article mentions at its close the brief life and sudden death of a society formed for home study for young men, modelled upon the older society, still vigorously flourishing, restricted to young women. Why there need be distinct organizations of that sort for the two sexes, it is a little difficult to see; but it is a little curious to find, that, hard upon the death of the 'Young men's society for home study,' a new organization has sprung up for the same purpose, but without limitation as to sex, bearing the somewhat pompous title of the 'Correspondence university.' It announces forty-one instructors (two of whom are women), resident in eight states of the Union, besides one each in Germany and Scotland. Sixteen of these are assigned to different departments of science, eleven to mathematics, and six to modern languages; so that the scientific leaning of our new 'university' is very marked. We shall look with much interest at the result of this experiment; for the promoters of the enterprise have certainly secured the services of many most excellent teachers, and they aim at a higher grade of instruction than has been attempted by the earlier organizations. A large proportion of the teachers are connected with Cornell university, which may be considered the headquarters. Unfortunately, as far as published, the plan appears to lack that unity and proper co-ordination which would at once command respect and confidence; and its higher grade of charges, though still very small, may prove an obstacle to its popularity.

We are glad to see a change in the wording of the 'indications' issued by the signal-service. Heretofore, variations of pressure have been indicated by 'rising' or 'falling barometer;' although change in the warmth of the air has always properly been mentioned as 'higher' or 'lower temperature,' and not 'thermometer.' Now the wording is made uniform, and observations of the barometer are recorded as implying 'increasing' or 'diminishing pressure.'

The late issue of *Copernicus* (a double number, 33–34) will be received with no little regret by many astronomers, as it contains the unwelcome announcement that this periodical will be discontinued after the publication of No. 36. We understand that this action on the part of the editors is due chiefly to the insufficient list of subscribers; and it is much to be regretted, as *Copernicus* is the only astronomical magazine, printed in quarto form, in which excellence of typography and general attractiveness in appearance seem to be thought desirable. Its style has been rather that of book than of magazine printing, and its papers on mathematical astronomy have had as fine a setting as the average article in the purely mathematical quartos.

The periodical began in January, 1881, under the editorship and management of Dr. Ralph Copeland, astronomer to the Earl of Crawford and Balcarres, and Dr. J. L. E. Dreyer, then of the Royal observatory, Dublin, and now director of the observatory at Armagh. The first six numbers were issued under the name *Urania*, for which *Copernicus* was then substituted, the editors having become aware of the previous existence of an astrological journal called *Urania*. Its many pages, devoted to the reviews of current astronomical literature, have formed a very valuable feature; and arrangements were, from the beginning, concluded with the Earl of Crawford and Balcarres whereby all the subscribers to this journal have received at the earliest moment the 'DunEcht circulars,' forwarded directly from Aberdeen. The new magazine has fairly established its claim to be 'an international journal of astronomy;' the chief astronomers abroad who have contributed to its support being the Earl

of Rosse, the Earl of Crawford and Balcarres, Drs. Wagner, Schjellerup, Ball, and Backlund, and Professors Klinkerfues and Bredicton. American astronomers have also done their full share; papers having been contributed by Dr. Peters, and Professors Pickering, Holden, Todd, Wright, and Stone. We express the hope that *Copernicus*, as a high-class journal for the publication of astronomical papers, may at some future time be re-issued under the same management as before.

LETTERS TO THE EDITOR.

**** *Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

'Illusive memory.'

THE subject presented in *Science* for March 7 (p. 274) under the above heading, by Mr. Osborn, if an obscure, is certainly an interesting problem in psychology. Its scientific treatment, however, will probably require a much wider range of investigation than that proposed by the writer. He has indicated 'two widely different theories' in explanation of the mental phenomenon: a third hypothesis appears to have escaped him.

Plato, as is well known, recognized this peculiar condition of the mind, and made use of it as an evidence of pre-existence, — a fancy embodied in the familiar lines of the poet: —

> "Our birth is but a sleep and a forgetting:
> The soul that rises with us, our life's Star,
> Hath had elsewhere its setting,
> And cometh from afar:
> Not in entire forgetfulness,
> And not in utter nakedness,
> But trailing clouds of glory, do we come."

If, now, we substitute for Plato's conception of an individual personal experience the more prosaic one of ancestral experience, we shall have, in brief, the third hypothesis, — the partial continuity of consciousness through genetic descent, instead of through metempsychosis or transmigration. From this aspect, the problem of the irreferable impressions of vague reminiscence would not fall under the class of *erinnerungs-täuschung*, or '*illusive memory*,' at all.

The modern reference of all the varied 'instincts' of animal life to the simple physiological datum of the heredity of a limited experience and memory, would naturally lead us to anticipate some such exhibition in the human race; nay, rather to wonder why we do not find such experiences much more pronounced and abundant. Notwithstanding the enormously greater expansiveness of cerebral action in man than in his lower fellow-creatures, the long-continued or reiterated impressions of a far-reaching ancestry would seem to justify the induction that 'intuitions' (so precious to the metaphysician) should be manifested in particular channels in a much stronger and more decisive form than we actually observe. Here, then, is a negative psychologic problem calling for explanation, and well deserving a careful comparative investigation.

To satisfactorily test this 'third hypothesis' is undoubtedly an extremely difficult undertaking, both by reason of the usual 'haziness' of these Platonic reminiscences, and of the rare opportunities of authentic verification of special parental or aval recollections. The question, however, is one of such biologic importance, that it merits an even laborious research; and, if in only one or two instances a clear evidence of such transmitted memory in man could be established, it would justify the inference that many similar cases are referable to the same principle.

The inquiry should include the antecedent experiences of grand-parents as well as of parents: since there is reason to believe that aval heredity is *relatively* more frequent than direct parental heredity; or, in other words, that there is a tendency to 'alternate generation' running through the animal kingdom.

Washington, March 13. W. B. T.

'The oldest living type of Vertebrata,' Chlamydoselachus.

In *Science*, No. 57, p. 275, my friend, Professor Cope, falls into the error of placing among the species of the genus Diplodus Ag. (re-named Didymodus by Cope) the 'peculiar selachian' recently discovered, and described by me in these columns. With the specimen before him, he would be the last man to make such a mistake. And no doubt he will thank you for giving the space necessary to a correction.

The most important of the characters on which the genus Diplodus was founded by Agassiz (1843, Poissons fossiles, iii., pp. 204, 209), that by which it is separated from Hybodus, Sphenonchus, and Cladodus, is a greater development of the secondary cones of the teeth, while the median cone remains rudimentary or comparatively undeveloped. This is not the case with Chlamydoselachus: it is not the secondary, but the median, cone in which is found the greatest development; agreeing in this respect with Agassiz' genera Hybodus, Sphenonchus, and Cladodus, in which "le cône médian l'emporte sensiblement sur les cônes latéraux, et se développe en quelque sorte à leur détriment." In the teeth of Chlamydoselachus, the cone at either side of the median is a mere rudiment. If the new selachian was to have been placed in either of the fossil genera mentioned, it should have been Cladodus. Mr. Cope says of Didymodus, 'The species possess two, three, or four denticles.' Of course, a second thought will increase the number so as to include Chlamydoselachus, which has more than four.

The propriety of placing living species in fossil genera of so long ago on account of resemblances in a single organ, such as a tooth only of a selachian, is to be questioned. The teeth do not give satisfactory clews to structure and shape of other organs, or of the body itself, in the majority of the sharks and skates. This is evident enough on comparison of the teeth of Carcharias, Alopias, Zygaena, Squatina, Torpedo, Scyllium, Raja, Triakis, Disceus, Mustelus, Trygon, Pristis, Potamotrygon, Rhinobatus, Dicerobatus, and others. It would be hardly worth the while to separate recent genera by the number and position of fins, or shape of body, and then make them equal to the same fossil genus on account of some similarity in teeth. Material in my possession will enable me, as soon as the necessary drawings can be made, to prove conclusively that Chlamydoselachus does not belong to the genus Didymodus of Cope (= Diplodus Ag.), and that it was hardly safe to announce Didymodus as the 'oldest living type of Vertebrata' until more was known about Chlamydoselachus.

S. GARMAN.

Cambridge, March 17.

The 'shark recently discovered in Japanese waters,' described by Mr. Garman as Chlamydoselachus anguineus (in *Science* for Feb. 1, vol. iii. pp. 116, 117; *Bull. Essex inst.*, vol. xvi.), as its describer has remarked, "is a form of more than ordinary interest on account of the respects in which it differs from the majority of its kindred." It not only appears as a new element in selachology, and becomes the representative of a hitherto unknown type, but it throws light on the ancestry and some of the extinct forms of the class; and, still further, it may serve as a guide for the interpretation of certain of the tales of the sea-serpent.

In respect to its place in the system, I perfectly agree with Mr. Garman, that it is the representative of a very distinct family (Chlamydoselachidae): I am also of the opinion that it may be regarded as the type of a distinct sub-order at least. Mr. Garman, in *Science*, was "inclined to consider this the type of a new *order*, to which the name Selachophichthyoidi might be given;" but in his article in the Essex bulletin he is entirely silent on the subject of the major relations of the new type. The name, having been thus never defined, and being objectionable on account of its length and cacophony, might be replaced by a shorter one, like Pternodonta; but on this I shall not insist. A more important question is, What is the status of the selachian in classification? Mr. Garman thinks that 'it stands nearer the true fishes than do the sharks proper.' I do not know how he would express this idea in a linear arrangement, but most would do so by placing it immediately between the selachians and fishes. I am also disposed to consider Chlamydoselachus to stand 'nearer the true fishes than do the sharks proper,' not because it appears to be in the line of descent *between* the two, but because it is nearer the primitive line from which both types have diverged. Judging from Mr. Garman's remarks in the two articles referred to, I presume there would be essential concordance between us as to this point.

As to the relations of Chlamydoselachus to extinct types, however, I must dissent from Mr. Garman. Fortunately, an article throwing light on the affinity of Cladodus has been published recently, — probably too recently to be available to Mr. Garman. I refer to Dr. R. H. Traquair's communication 'on a new fossil shark,' in the *Geological magazine* for January, 1884 (decade 3, vol. i. pp. 3–8, pl. 2). Dr. Traquair has therein made known the form of the cladodont selachians, and proved beyond doubt that the cladodont dentition and ctenacanthoid spines co-existed in the same fish. The 'new shark' in which these parts were coincident has been named Ctenacanthus costellatus. In the words of Dr. Traquair, "accepting the fish just described as a new species of Ctenacanthus, it yields us the following important facts regarding the genus:—

"1. The shape of the animal was moderately elongated, with blunt snout and heterocercal tail. 2. The skin was covered with shagreen granules, mostly of an ornate, ridged, pectinate character. 3. There were two dorsal fins, each with a spine, that of the first being the longer. There were no paired spines, and the ventral fin was opposite the second dorsal. The presence of an anal fin is doubtful. 4. The dentition was cladodont. 5. The vertebral axis was unsegmented, but there were extensive calcifications in connection with other parts of the skeleton."

It is obvious from this summary, that Cladodus was not at all related to Chlamydoselachus; and I may add, that it did not have the essential dentition of Chlamydoselachus, so well indicated by Mr. Garman in the statement that "each tooth has three slender, curved, inward-directed cusps, and *a broad base . . . preventing reversion.*"

But, as Professor Cope has claimed (*Science*, vol. iii. p. 275), Chlamydoselachus did have a representative in the carboniferous genus Diplodus, or Didymodus; although I do not think that the two can be congeneric. In fine, the recent discoveries by Messrs. Garman and Traquair enable us to co-ordinate a number of extinct types, and compel us, I think, to add two sub-orders or orders to the list of those necessary for the long-known living forms. The living sharks I have proposed (in Jordan and Gilbert's Synopsis of the fishes of North America, p. 967) to distribute among four sub-orders; of which the Opistharthri or Notidanidae are the most generalized, and the Rhinae or Squatinidae the most specialized. The two additional sub-orders appear to be still more generalized than the Notidanidae, and the sequence would therefore be as follows:—

1. Lipospondyli, including selachians without developed vertebrae, but with a persistent notochord, and comprising the family Hybodontidae (Hybodus, Cladodus, Ctenacanthus, etc.).
2. Pternodonta or Selachophichthyoidi, including Squali with vertebral condition unknown, and with teeth having fixed bases, comprising the family Chlamydoselachidae (Chlamydoselachus and Didymodus).
3. Opistharthri or Cyclospondyli.
4. Proarthri (Heterodontidae).
5. Anarthri (most living sharks).
6. Rhinae.

It is by no means certain that the hybodontids are Squali at all, and they may prove to be more nearly related to the Holocephali. The plate of Dr. Traquair's memoir delineates very plainly one external branchial aperture, and one only; and the condition of the vertebral column and dorsal spines are features in which there is greater resemblance to the Holocephali than to the Plagiostomes. The primitive form from which the two diverged must theoretically have been not unlike the new Ctenacanthus, and it is quite possible that in the hybodonts we may have one of the 'missing links' between the two groups.

I had intended to refer to certain of the 'sea-serpents' which might be correlated with Chlamydoselachus; such as the Maine animal noted recently in the *Proc. U. S. nat. mus.*, the animal seen by Capt. Hope about 1848, and the selachian found in 1808, and partially described by Dr. Barclay, but must defer a notice to a future time. THEO. GILL.

Evidence of unrecorded tornadoes.

There is evidence in the forests of Pennsylvania that many localities have been visited by tornadoes of which no accounts have ever been recorded. The places referred to are called 'windfalls;' the timber having been prostrated apparently by violent storms of wind, while the trees immediately adjoining remain erect and undisturbed. Sometimes, instead of forming a path through the forest, the tornado has descended, and quickly ascended into the air, leaving its marks on a small area. Judging by the remains of the timber-trees thrown down, these events were of all ages, and of various degrees of violence. Sometimes the fallen timber was found sufficiently sound, after the first settlement of the country, to be worth manufacturing into lumber; in other cases, being older or more shattered, it was worthless; while in others it has entirely decayed and disappeared, the ground being covered with a later growth of a smaller and different kind, and the sur-

face dotted with hillocks, like rifle-pits, caused by the up-turned roots of large trees, of which no other vestige remains. In the eastern part of Bradford county were extensive ancient windfalls, still recollected by the older inhabitants, where now is a fine, well-cultivated farming-country; and in the southwestern part of the same county a tornado of a later date left a long, straight path through the pine timber, which was known as the 'Devil's Lane.' I have seen the track of an extensive tornado in the forest of one of the Alleghany Mountain counties of this state. I have reports of others in West Virginia and in Indiana, and of very numerous ones in the vast forests of Lower Canada, in New Brunswick, and Nova Scotia. Every hunter and lumberman who has travelled through the forests is familiar with these evidences of more or less ancient tornadoes, and of a few in later times. From their occurring in uninhabited regions, and from their not being attended with loss of life or improvements, no accounts of them are to be found, and the traditions of them are soon forgotten. In the further study of this interesting subject, these fossilized tornadoes, so to speak, should not be overlooked. The tornadoes of Kansas, Missouri, Illinois, Minnesota, and Georgia, are probably only repetitions of what has at long intervals occurred fortuitously in all parts of our country.

JAMES MACFARLANE.

Towanda, Penn., March 11.

[Windfalls are the subject of Tornado circular No. 12, which may be obtained on application to the chief signal-officer, U. S. Army, Washington. Information concerning the location, direction, length and width, and, if possible, also the date, of these old tornado-tracks, is much desired.]

Remains of a prehistoric tree.

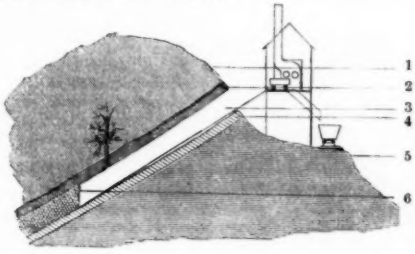
While making some assays for the Oregon iron and steel company, during the past summer, I was often in the mines of the company at Oswego, eight miles south from Portland, Ore.

Being on one occasion about five hundred feet down the main gangway, my attention was called to a curious 'hole in the roof.' On examination, I found it to be a perpendicular cylindrical cavity in the roof-rock, in diameter about ten inches. Upon feeling the walls of the cavity, I found the surface somewhat rough, like the bark of a tree. Introducing a lamp, I could discern small indentations corresponding to the knots and twigs upon the trunks of trees. I was convinced that the hole had once been occupied by a tree, and, procuring a jointed pole, probed the cavity to a height of twenty-two feet. Toward the top the indentations became more numerous; and, by replacing the stiff pole by a flexible bamboo, the side orifices could be probed to a depth of two or three feet, and seemed to have a slight inclination (see figure).

Examining the ore on roof and sides, I was rewarded by finding a network of roots, which retained their original forms perfectly, although petrified. I procured one specimen an inch and a half in diameter. An analysis of it showed the material occupying the position of the original bark to be kaoline; it being perfectly white, and about a quarter of an inch in thickness. Inside this ring of kaoline the wood had been replaced by iron ore, not differing from that of the surrounding vein.

Above and below the ore I found no roots; the tree having grown in the space now occupied by the ore-vein, and at an inclination to it. The strata dip to the north at an angle of 35° to the horizon.

Immediately under the ore is a stratum of scoriae one to three feet in thickness. Below this is hard, compact basalt. The roof of the mine is 'greenstone,' decomposed by heat to coarse sand-rock immediately over the ore. The ore-vein averages five feet and a half in thickness.



SECTION IN MINE AT OSWEGO, ORE.

1, 'greenstone;' 2, sand-rock; 3, gangway; 4, scoriae; 5, basalt; 6, ore-vein.

At six hundred feet I found pieces of wood not petrified, and in a good state of preservation, some parts showing a charred surface. I found afterwards, in other parts of the mine, several smaller orifices in the roof-rock, and similar to that described above.

HAROLD B. NYE.

Congenital deafness in animals.

Mr. Lawson Tait, quoted by Professor Bell in *Science*, No. 54, says that 'congenital deafness is not known to occur in any animal but the cat.' In contradiction to this statement, Dr. Burnett has reported to you (No. 57) the cases of two deaf dogs; and I now refer you to the mention of *a deaf-mute cow* in Dr. Haubner's 'Bericht über veterinärwesen,' quoted in the 'Organ der taubstummen- und blinden-anstalten in Deutschland,' vol. xxv. p. 176. This cow was twelve years old, and had been in the possession of the same owner since she was three weeks old. She was perfectly deaf to all sounds. At feeding-time, or when a calf was taken away from her, she made the same demonstrations that other cows do, stretching out her head and neck, and opening her mouth wide as if to bellow, but only making a short, deep, gurgling sound, very different from the ordinary lowing of cattle. Her sight was good, and she was an intelligent animal. Nothing abnormal could be discovered in her ears or throat. Her color is not mentioned. She had had eight calves: but whether these inherited their parent's deafness is not known; for in this case the danger, if such a danger existed, of 'the formation of a deaf variety' of the bovine race was effectually prevented by the early butchering of the calves.

EDWARD ALLEN FAY.

National deaf-mute college, Washington, D.C., March 14.

Muraenopsis.

Is it not by mistake that you state, in the review of 'Yarrow's check-list' (*Science*, No. 56, p. 264), that the generic name 'Muraenopsis' must be suppressed because 'pre-occupied among the eels'? The name was first applied to eels by Kaup (1856, 'Catalogue of apodal fish,' p. 11), though credited by him to Le Sueur. The latter, however, did not use it. His name was 'Muraenophis' (1825, *Journ. Philad. acad.*, v. p. 107), or 'Muronaephis' (l.c., pl. iv.), or 'Muroenophis' (l.c., index). Kaup's error was copied by

Günther (1870, 'Catalogue of fishes,' viii. p. 68). It is probable that by one or the other of these authorities you have been misled. 'Muraenopsis' was given to the batrachian by Fitzinger (1843, 'Systema reptilium,' p. 34) as a substitute for Amphiuma Garden, 1821. Subsequent writers have limited the genus Muraenopsis to the species with three toes, retaining in Amphiuma that with two. Examination of a considerable number of specimens shows that about one of every five individuals of tridactyla, from the same locality, has less than the normal number of three toes to each foot. For this reason it seems as if the species is not sufficiently distinct from the two-toed, Amphiuma means, to be entitled to rank in a different genus. In this view the genus Muraenopsis should be suppressed, and the name placed as a synonyme for Amphiuma.

S. Garman.

Mus. comp. zoöl.

[The writer of the review above mentioned must confess to a blunder. Not having a copy of Le Sueur's paper at hand, he trusted to the quotations made by Kaup and Günther. The former writer, as above stated, expressly adopts the genus Muraenopsis from Le Sueur.]

STUDY AT HOME.

In discussing the value of a new plan for making men wiser and better, the thing to do is not to compare it with other plans in successful operation, with which it does not propose to interfere, but simply with the state of things in which it is absent. No one pretends that personal instruction is not of value, or that the urgent stimulus and vivid directness of a living teacher and a *viva voce* explanation can ever be replaced by the slow medium of letters. When an organized effort was made to introduce home study on a large scale, it was on account of the patent fact that there are many young people, and many people no longer young, who are not in a condition to go to school, and to whom, nevertheless, the systematic study of some subject in which they take an interest would be a benefit and a delight. The difference between a sporadic effort to do a little solid reading by one's self, constantly interrupted by flagging interest and by difficulties too hard to overcome, and a regular correspondence with some one who is able and willing to lend encouragement and aid, is very great. If the enthusiasm for this sort of work should become so wide-spread as to keep large numbers of students from giving themselves a regular course of instruction in school and college, it would be time to consider the evils of the plan; but of this there is little danger at present.

Ten years ago some reports of an English organization, called the 'Society for the encouragement of home study,' fell into the hands of a group of missionaries in Boston; and they were immediately inspired with a desire to work out the idea suggested by the title. An exchange of letters with the English secretary was of very little assistance in the development of the American plan. The English society offered no correspondence, but simply sketched out courses of reading, and plans for botanical and art work, to be carried on without assistance for a year, after which the students were expected to go to London for a competitive examination with prizes. In the autumn of 1873, the 'Society to encourage studies at home' was established by a committee of ten persons, six of whom carried on the correspondence with the forty-five students who offered themselves for instruction in the course of the year. Only two points of method were settled at the beginning; namely, that there should be a regular correspondence, and that there should not be competitive examinations. Later the plan was developed of making the students take notes from memory, at the beginning of each day's work, of the reading of the day before, and send to the appointed teacher at the end of each month a few sample pages of their daily notes, and a full abstract, written from memory, of their month's work. There are also frequent examinations; and by this means the students are divided, at the end of the year, into a first, second, and third rank. The plan of giving certificates, based upon the results of an annual examination, was abandoned after two years' trial. The annual fee charged is merely a nominal one, — two dollars at first, and afterwards three, — but it has been sufficient from the beginning to cover all the expenses of paper, postage, the printing of the necessary circulars, the salaries of the assistants to the secretary and the librarian, and for the last two years the rent of the rooms on Park Street, Boston, where the society has its headquarters.

The work of the teachers is, of course, a labor of love. In numbers the society had a very rapid growth for the first four years of its existence, and since then it has remained nearly stationary. In 1880 over eleven hundred students entered, of whom seventy-one per cent persevered throughout the year, and twenty-six per cent were excused for sufficient reasons. The number of teachers is about two hundred. History, science, and art, French, German, and English literature, are the subjects taught; and the proportion of students in each subject remains almost constant year after year. More remarkable still, the subjects divide themselves into three groups of two subjects each, which keep nearly abreast

of each other. An average of the last four years shows, that, out of every hundred students who have persevered, thirty-four have taken English literature and thirty-three history, twelve have taken science and eleven art, five have taken German and four French. History is taught by topics, and there are circulars giving minute directions for critical study in the literatures of the different languages. The Shakspeare paper is particularly suggestive and valuable. Much thorough scientific work is done, if it is of an elementary character. Geology and mineralogy are taught by sending specimens and requiring observation and description, as in the class-room. Excellent work has been done in blowpipe analysis, and several students who live in fossiliferous regions have made discoveries in their own neighborhood. Botany has always been well taught: most of the teachers have been pupils of Gray, Goodale, and Farlow. Biological subjects have not been popular; possibly owing to the lingering survival of a lady-like repugnance to frogs, mussels, and moulds. Physics and chemistry have not been attempted. That the scientific department is thoroughly well conducted is assured by the fact that it is under the charge of the head of the woman's chemical laboratory of the Massachusetts institute of technology.

The society has a lending-library, which began with the purchase of twenty-nine books in 1874, and which has now about a thousand volumes, many of them valuable works in illustration of archeology and art. Out of the eight thousand issues which have been made to the most distant states and territories, through floods and railroad accidents, only twelve volumes have been lost in the mails, and five through the carelessness of students. A small pamphlet enforcing obedience to the rules of health has been prepared by the secretary, and is sent to every one who joins the society. The pupils are widely distributed, both socially and geographically. Massachusetts and New York have always furnished the largest number, but not so many as the remaining Middle States together. The extreme south and the remotest west, as well as the Canadian provinces, are well represented. Many industries and all grades of society, above absolute penury and ignorance, furnish students. There are girls in cities with large allowances, and married women far from any post-office, who do their own household work. A telegraph-operator, a compositor, a matron of a public institution, a railroad paymaster (acting also as treasurer, and going up and down her road in that capacity), a colored teacher at the south, another colored woman well married at the north, have taken advantage of the society's courses. Six deaf-mutes have been among the pupils; and one, after studying several years, has become an associate teacher, and takes charge of four of her companions in misfortune. Mothers study for the sake of teaching their children; and even grandmothers, not to be left too much alone, join the rest of the family group. In age, half the pupils are between twenty and thirty, and one-fourth between thirty and fifty. Many continue their studies for several years. Last year there were more old students than new. One has been eight years in the society, has taken a full course in many subjects, has read a small library of important works, and has taken, after the first two years, the first rank in every thing. "Now and then an enthusiastic student tells us that she hopes to continue with us all her life;" and one writes, "The very thought of leaving makes me homesick." Those who have only known the active life of cities can have no idea how great a boon to a country girl is a correspondence with an intelligent and sympathetic woman. The students' letters are full of appreciation and gratitude. One says, "I only regret that I did not know of the society at the beginning of its existence;" and another speaks of having derived "pleasure and incalculable benefit from the systematic course of study prescribed." After buying a science text-book, a student writes, "It has cost me my summer hat, but I do not regret it in the least;" and another, "I pin my lesson copied the night before, to the kitchen wall, and the drudgery of dish-washing is removed." With such eager material to work upon, it will be strange if the society does not find some mute, inglorious Herschel, or some village Somerville, upon whom it will act as an inspiration to great things. If Du Bois Reymond was able to become a great physiologist at a time when rubber tubing was not an article of commerce, a girl who has learned to use the blowpipe by teaching at a distance must blame herself, and not her circumstances, if she does not do good work as a mineralogist.

A society for home study for young men has had an existence for three years, and has come to an end. Longfellow, Howells, and Holmes, John Hay, Justin Winsor, and Charles Dudley Warner, are among the names on its committee, and the reports for the first two years were very enthusiastic. They state that the students are twice as many as in the young women's

society for the corresponding years, that the average time given to study is ten hours a week instead of eight, that there has been no difficulty in finding a large number of cultivated gentlemen who were willing to give their time and attention to the work, and that the wonderful success of the earlier society may be taken as an indication of what may be done for young men by the same means. The secretary says, "This year's work has convinced us that we have every promise of the society's becoming a successful and useful institution, and that it is meeting a great need in a practical way." A year later it is decided to give up the organization; and no more specific reason for this course is given than that the committee is satisfied, on the whole, that the good done is not enough to make worth while the labor required of officers and correspondents.

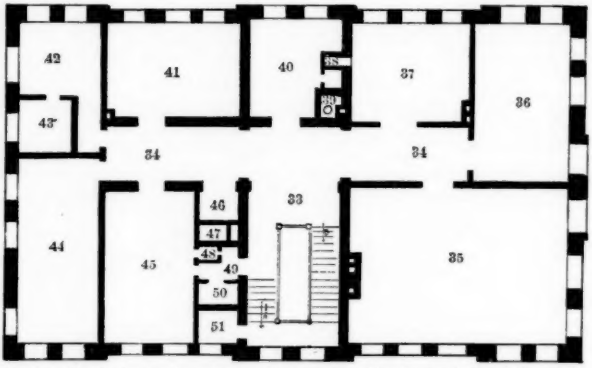


Fig. 2.—33, 34, hall and corridor; 35, museum; 36, advanced morphology; 37, preparation-room for museum; 40, assistant's room; 41, library; 42, 43, photography; 44, advanced botany; 45, lecture-room; 46, elevator; 47, 39, ventilating-shafts; 51, lavatory.

THE BIOLOGICAL LABORATORY OF THE JOHNS HOPKINS UNIVERSITY.

The recently opened biological laboratory of the Johns Hopkins university is eighty-four by fifty-two feet in external measurement, and consists of three stories and a basement. It is built of Baltimore pressed brick; with steps, entry, window-sills, and band-courses of Cheat-river bluestone. While free from any attempt at mere architectural display, the building is handsome, as will be seen on examination of fig. 5, which represents its north and west elevations. A fact that at once attracts attention is the number and large size of the windows: as the laboratory is free on all sides, it is therefore very well lighted.

On ascending the front steps, and passing through the door, the visitor enters the main hall, from which a wide staircase ascends to the third story, and on which most of the rooms of the first floor open. This floor is given up to the regular class-instruction of students not engaged in special work. It has on it (see plan, fig. 1) a lecture-room with seats for sixty; a storeroom connected with this, for the keeping of diagrams and lecture-apparatus; an administration-room, the headquarters of the chief assistant; a preparation-room containing a supply of the reagents, specimens for dissection, and histological material required for the daily practical class-work; and the large general laboratory, thirty-two by forty-eight feet.

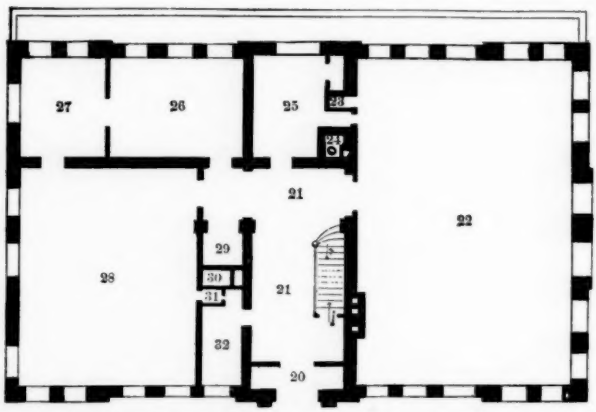


Fig. 1.—20, vestibule; 21, main hall; 22, work-room for practical instruction of less advanced students; 24, 30, ventilating-shafts; 25, storeroom of materials and reagents for general practical class-work; 26, chief assistant's room; 27, storeroom for diagrams and lecture-apparatus; 28, lecture-room; 29, elevator; 32, cloak-room.

The latter (fig. 6) has windows on three sides. Around these sides runs a work-table, supported, independently of the floor, on brackets attached to the walls, and affording ample space for thirty students. If necessary,

a second table can be set inside this, giving places for fifteen or twenty more. The centre of the room is in part occupied by a dissecting

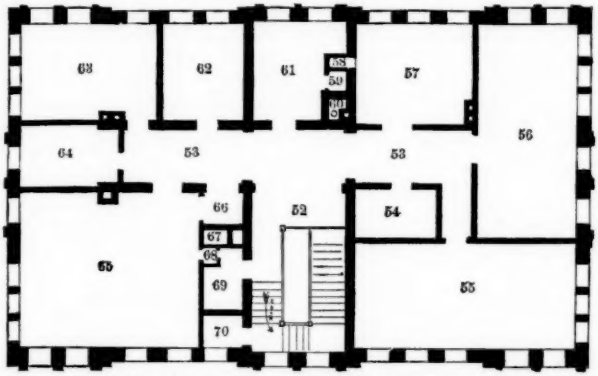


FIG. 3. — 52, 53, hall and corridor; 55, experimental physiology of lower animals; 56, advanced histology; 57, workshop; 54, balance-room; 61, assistant's room; 62, myograph-room; 63, director's private room; 64, dark chamber; 65, experimental physiology of mammals; 66, elevator; 60, 67, ventilating-shafts; 69, closet; 70, lavatory.

and a chemical table. The latter is supplied with the reagents and appliances for practical work in elementary chemical physiology. The dissecting-table is for the dissection of animals, such as cats and dogs, which are of a size not to be conveniently handled at the regular work-places on the wall-tables: it has a slate top, and is provided with a sink and water-tap between every two students. The inner side of the room has, against the wall, tables for scales and the warm-water oven; a large hood for the performance of chemical operations calculated to give rise to noxious vapors; and a dumb-waiter leading to the basement, on which articles can be sent up from the store-rooms there when called for. Near the centre of the room is a chute, lined with plate-glass (so as to be readily kept clean), and passing direct to the furnace-room below. Through this chute all refuse is at once got rid of. The floor of the room, and of all others in the building in which messy work has to be done, is of asphalt, and the walls of hard cement to a height of two and a half feet. Thus no spilled blood or other offensive matter is absorbed; and the floor can be flooded with water, and thoroughly cleansed, whenever desirable.

The work to be done in this room annually is as follows: by first-year students, a thorough macroscopic and microscopic examination of about twenty-five selected vegetable and animal organisms illustrative of the course of lectures on general biology, and a study of the embryology of the chick; by second-year students, a course in practical animal physiology and histology a little more extended than that given in Foster and Langley's 'Practical physiology,' but essentially similar to it, and the thorough dissection of a dog or cat.

The second floor (see plan, fig. 2) contains the following rooms: a laboratory for research and advanced study in animal morphology, and a corresponding room for botanical work; a photographing-chamber, with heliostat and other appliances for micro-photography; a library of biological text-books, monographs, and journals; a small lecture-room (to be used for the present as the laboratory of psycho-physiology) capable of seating about thirty; an assistant's private room; a museum containing such typical osteological and other specimens as are needed by students pursuing the regular courses of class-instruction, and the beginning of a collection of the local fauna

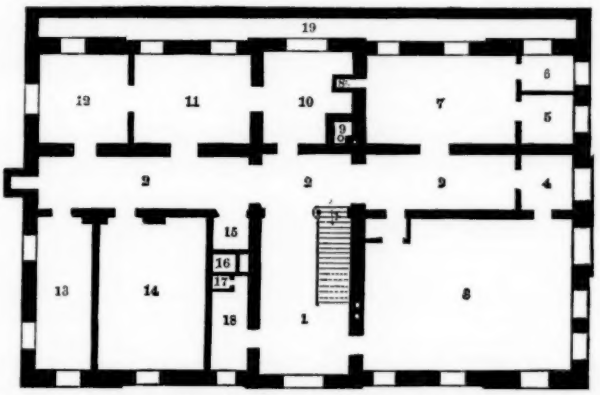


FIG. 4. — 1, 2, entrance and corridor; 3, chemical physiology; 4, balance-room; 7, furnace-room; 10, 11, 12, janitor's store and battery rooms; 13, animal-room; 14, electro physiology; 15, elevator; 16, 9, ventilating-shafts; 18, lavatory.

and flora, made by the members of the field-club; and a store and preparation room for the curator of the museum.

The third floor (see plan, fig. 3) contains three main work-rooms for advanced students, — one for animal histology, one for physiological experiment on invertebrates and the lower vertebrates, and one for experiments on warm-blooded animals. The room for the latter purpose communicates directly with the hydraulic elevator, which has also doors opening directly on the corridor of each floor, and runs to the basement: there is consequently no carrying of animals or their remains up or down the stairways. The other rooms on the third floor are, a dark chamber for spectroscopic work, for experiments in physiological optics, etc.; the director's private room; a room for the myograph; an assistant's private room; the mechanics' shop, for the construction and repair of instruments; and a small balance-room, containing also a case with a supply of chloral, curare, morphia, and other drugs frequently employed in physiological experiments.

The building being heated by steam supplied from a boiler in the neighboring chemical laboratory, the basement (see plan, fig. 4), which is well lighted, is left free for use. The scientific work-rooms in it are, a large, well-equipped room for advanced study in chemical physiology, a balance-room, and a room for the study of animal electricity. The basement also contains a suite of three rooms, which form the janitor's headquarters, where he has charge of the necessary stock of chemicals and glassware, and has also a carpenter's bench, at which he does any simple bit of carpentering required. From one of these rooms a shaft two feet square runs to the top of the building, communicating with each floor. Through this shaft it is intended to run wires to various work-rooms, transmitting electrical currents for the running of chronographs, and for similar purposes. The shaft was also planned in the hope that ultimately the clock-work of kymographs and such instruments will be replaced by electrical energy generated by an engine and dynamo in the basement, and distributed thence over the building.

Fig. 5.

The remaining rooms in the basement are, the 'animal-room,' fitted up with tanks for the keeping of frogs, terrapins, and so forth; and the furnace-room. The latter contains a cremation-furnace, in which all the combustible *débris* of the laboratory is disposed of, and a boiler and condenser for the preparation of distilled water: it has also in it a small steam-engine, designed to be used for running a centrifugal apparatus.

In the general internal fitting-up of the laboratory, the trustees of the university have acted upon the belief that it is, in the long-run, more economical to provide students with furniture which is good and attractive, and trust them to take care of it, than to supply cheap tables and cases, which the average undergraduate, at least, is apt to feel no hesitation in mutilating. The halls and lobbies are comfortably covered with cocoa matting; the tables, instrument cupboards, and cases of drawers are of polished cherry. But there has been no attempt at ostentation: the furniture is all simple, though handsome, and finished in every essential in the best manner. Every drawer runs as smoothly as in the best cabinet work: and each has its own lock, to be opened only by its own key, or the master-key for each floor kept in the administration-room.

The library is a little more luxuriously furnished than the other rooms. It is carpeted, and supplied with armchairs. So many students can only afford to hire rather uncomfortable lodgings, that it was believed desirable to provide in the library a really pleasant study, in which they might find at hand, not only the books they wanted, but writing-tables and other conveniences. None of the books are locked up. The student, on entering, finds before him a list of books which are not to be taken from the room, including text-books, monographs on the plants or animals which are used as types in the regular class-instruction, and the last-received numbers of periodicals: all other books may be taken (subject to call for immediate return at any time) on the student writing his name, and the title of the book he desires to take away, on a card provided for the purpose, and then slipping this through a slit in a locked drawer. The fellows and scholars in the biological department act in turn as librarians for the day, and are present

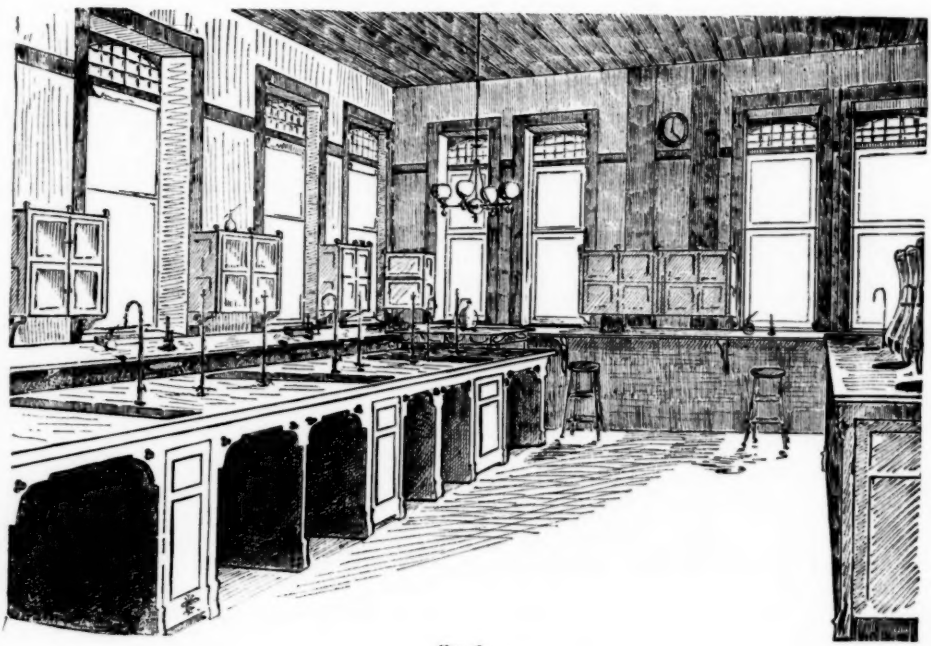


FIG. 6.

at a stated hour to receive books returned, and restore the receipts for them: until the card is returned to its signer, he is responsible for the book. This system of almost absolute freedom in taking books from the library is still on its trial: it has now been in practice for four months, and with the best results. Those who desire to take books home appreciate the trust reposed in them, and also the convenience to them of the present plan, and are anxious to secure its continuance.

The principle on which the library is managed, of inviting students to co-operate with the administrative officers in making it possible to allow the freest use of all books in it compatible with their safety, has been extended to the instruments in the various rooms for advanced work. On admission, each man has assigned to him a microscope, microtome, other histological appliances, and such chemical glassware as he is pretty certain to need. For these he signs a receipt, undertaking to restore the articles in good order on demand, or pay a specified sum for them. Glass slides and covers are purchased in quantity, and supplied by the janitor at cost. Other glassware, only occasionally needed, is supplied to any member of the laboratory on requisition, the recipient signing an agreement to return or pay for it. With these exceptions, free use of all instruments required for such work as he has been permitted to undertake is allowed to every student, on condition that upon removing any piece of apparatus from its drawer or cupboard he shall leave in its place a card bearing his name. The only alternative, of course, is to lock every case, and only issue apparatus on formal application to a special officer. The men are on their honor, and also know, that, if instruments cannot be traced, the present system must cease. Hitherto the endeavor to secure their aid in carrying out this plan of making all the apparatus accessible with the minimum of trouble or delay, has had most satisfactory results; largely, no doubt, owing to the fact that the majority of the students are graduates old enough to have a sense of responsibility, and to influence the younger men. Once a month one of the fellows, or graduate scholars, examines the instrument cupboards in each room, compares their contents with the inventory, notes what piece of apparatus has been taken and who has taken it. If any instrument is not accounted for, he posts a notice asking who has it. During the past four months the latter proceeding has been necessary only three or four times, when students had, in the hurry and excitement of an experiment, forgotten to write the required receipt: in every such case the delinquent has at once come to apologize and explain. What may be called the 'permanent' apparatus in the laboratory, as distinguished from glass tubing and other perishable 'current' apparatus renewed yearly, has cost more than ten thousand dollars: about fifteen hundred dollars are annually provided for repairing and adding to it. During the current year another five hundred dollars has been placed at the disposal of Dr. Stanley Hall for the purchase or construction of apparatus for psycho-physiological teaching and research. This stock of instruments is so valuable, and in many cases so easily injured, that a longer trial will, of course, be necessary, before it can be decided whether the present system of leaving every thing unlocked, and trusting students to leave an acknowledgment for such instruments as they take, can be continued without undue risk of loss or injury by carelessness for which no one can be found responsible.

The work for which the laboratory has been planned and built was stated in Professor Martin's lecture, published in our issues of Jan. 18 and 25. Briefly, it is the training of beginners in biology in the fundamental properties of living matter, and the structural and physiological characteristics of the chief groups of plants and animals; in co-operation with the seaside laboratory of the university, to afford opportunities for advanced study and research in animal morphology and embryology; and, ultimately, similar opportunities for advanced students of botany. In addition, very special attention has been given to providing facilities for class-instruction, advanced study and research in animal physiology and histology, and opportunity for such senior students as intend to become physicians to learn the methods of experimental pathological and therapeutical research, so far as they can be carried on in a laboratory. It is hoped that in this way the biological laboratory may prepare annually some students to enter special laboratories of pathological or pharmacological research more immediately connected with a medical school.

SOME PECULIARITIES OF PLANT-GROWTH.

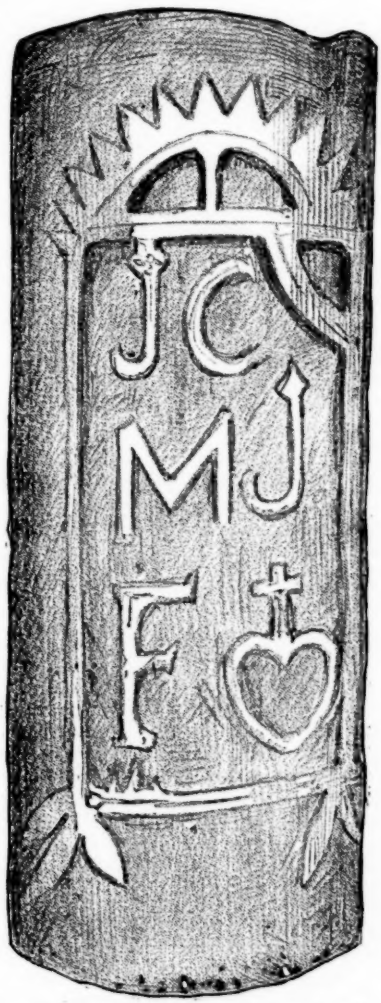
The following cases are here placed on record as affording interesting instances, not only of the ability of plant-tissues to repair injury, but of the enormous power exerted by vegetable structure during the process of development.

In the summer of 1873 I discovered a very interesting case of the lifting-power exerted by roots during growth, and in 1875 called the attention of my friend, Col. W. S. Clark, to the fact. He made measurements of the various parts, and noted the case in the *Scientific farmer* of Oct. 1, 1875. I cannot do better than reproduce his description, as follows: —

"On a ledge of coarse granite in the town of York, Me., stands a black birch (Betula lenta) which is about forty feet high, with a trunk two feet in diameter. The seed from which it sprang germinated in a narrow seam of the rock at a point eight feet from the ground in a perpendicular direction, and some fifteen feet along the line of the seam, which descended at an angle of forty-five degrees. The first rootlets of the young plant penetrated the seam until they reached the earth, from which supplies were to be drawn for the nourishment of the future tree. The mass of rock above the roots was more than fifteen feet long, from five to ten feet wide, and from one to three feet thick." Its weight was thus very nearly twenty tons. "Only two slender rootlets undertook the task of lifting and carrying this enormous load. One passed down nearly under the centre of the rock; and the other, two or three feet from the first, and so near the edge that at one point it has been forced out from under the rock, forming a sheet eighteen inches in width. The base of the trunk where it enters the seam now measures four feet in width and one foot in thickness. The mass of rock has been elevated twelve inches, and carried sideways eight inches by the expansive power of these two roots, which have not only borne this immense burden, but have supplied the crude sap for the development of the tree. It is but trifling to add the fact that they have not only raised the rock, but also the entire tree, from an eighth to a quarter of an inch every year."

The man on whose land this was found said he well remembered the time when it was impossible to insert his finger in the widest part of the seam. This is only one of the many similar cases which occur naturally, and is not more striking or suggestive than the force exerted by the mammoth squash in lifting a five-ton weight.[1]

In 1875, when carrying on some experiments with the squash-vine, it became necessary to remove the young squashes. This was accomplished by passing a knife through the stem of the squash, leaving the latter in position for future collection. One squash, though cut from the vine, was overlooked in the first collection; and, when the final harvest was made, it was discovered firmly united to the stem, and of a very good size. Upon careful examination, both outwardly and under the microscope, it appeared that (1) when the cut was made,



A BLAZE WHICH HAD BEEN COVERED BY MANY YEARS' GROWTH.

the squash was not displaced, and the cut surfaces immediately came together again; (2) as determined by a 'fault' in a crack of the epidermis, the squash rotated in position as the cut was made, thus accomplishing a displace-

[1] Clark, Phenomena of plant-life.

ment of nearly one-fourth of an inch on the surface of the stem; (3) the healing was complete in the interior, but the line of section was plainly visible under the microscope; (4) there was a displacement of the vascular bundles corresponding with the surface displacement; (5) the epidermis dried and shrank away before union could be completed, and there was thus left a V-shaped groove which extended completely round the stem, and demonstrated the completeness of the section in the first instance.

In the Redpath museum of McGill college there is a most interesting case of an old blaze on a beech-tree, which, in the course of a few years, came to be completely covered by the new growth. The specimen came originally from Belle Rivière, county of Two Mountains, and was discovered when cutting up the tree for firewood. It was exhibited before the Montreal natural history society, at its meeting in April, 1882; but no special description of it was published.[1] It is therefore thought desirable to figure and describe it here (see preceding page).

The figure, as blazed, is shown in the accompanying drawing; and its general character shows that it was probably made by one of the early Catholic missionaries, who little dreamed that it would be so effectually preserved. An examination of the stump showed by actual count at least one hundred and sixty rings of annual growth external to the blaze; and the size of the original tree is still clearly defined, showing that it was four inches and a half in diameter.

Two impressions are to be observed, — one representing the original marking; and the other, a cast from it, made by the overgrowing wood; both being very clearly defined. We have to note the following: —

1. That the figure was cut with a knife, as shown by occasional incised lines; though the outer cast, being in black, at first leads one to the belief that a hot iron was employed. Upon closer examination, however, it seems more probable that the black or carbonized portion was the result of slight decay, the decayed portion being subsequently covered up, and thus producing the appearance described.

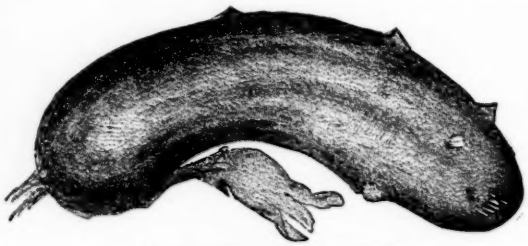
2. That the destruction of the bark and cambium was strictly confined to the lines of the figure, the intermediate portions still retaining their vitality and power of growth.

3. As now seen, the figures of the original blaze are defined by a stronger localization of coloring-matter in the wood, along the entire outlines, as shown in the drawing.

4. This offers a very good illustration of the tendency of active vegetable tissues to heal over abraded surfaces, and repair injury, the degree of reparation depending upon (*a*) the special vigor of the plant, and (*b*) upon the extent of the surface injured.

[1] Canadian nat., new ser., vol. x. no. 4, p. 238.

In 1879 I discovered a very interesting case of adhesion in a cucumber growing in the plant-house. My attention was not called to it until in an advanced stage of development.



FLOWER GROWING UPON A CUCUMBER.

as represented in the drawing, which is of full size. As is here seen, the monstrosity literally consisted of a flower growing upon a well-developed cucumber. As shown in the figure, the abortive flower was borne on a conspicuous peduncle, which became merged at its base with the base of the cucumber. The entire relation of parts would seem to indicate that there must have been two axillary flowers which became united in the early formation of the buds; one of them subsequently developing normally, while the growth of the other was largely arrested.

D. P. Penhallow.

McGill university, Montreal.

THE NATAL OBSERVATORY.

Mr. Edmund Neison, the government astronomer at Natal, submitted to the colonial secretary, in June last, his report on the Natal observatory, whose establishment has been mainly due to the active exertion of Mr. Escombe. It was decided to found the observatory in time to obtain observations of the then approaching transit of Venus of 1882; and, on being applied to, Mr. Gill, the astronomer royal at the Cape, furnished an estimate of the cost of a suitable establishment. A generous sum was secured at first by private subscription; and in June, 1882, the sum of three hundred and fifty pounds was voted by the corporation of Durban toward the expense of founding the observatory, and the next month this was supplemented by a special vote of

five hundred pounds by the legislative council. In all, a sum of about nineteen hundred pounds was contributed.

Under the superintendence of Mr. Robert Pett, of the Cape observatory, the new establishment was constructed, and the instruments erected. On the 1st of December, Mr. Neison took possession of the observatory as astronomer to the Natal government, and subsequently the observatory was taken over by the government of the colony. It lies on the south-west corner of the land originally granted for the use of the botanic gardens, and is a substantially built, rectangular red-brick building with cement facings, and carries a light wooden upper structure, forming equatorial and transit rooms. At present, there being no protection from the direct rays of the sun, the substantial walls of the observatory become so hot in the day, that it will be difficult to obtain proper observations until the building is completed by the erection of a veranda to shield the walls, and prevent their becoming so intensely heated. Having become thus raised in temperature during the day, the walls, owing to their massiveness, require the greater portion of the night in which to cool; and during this time they give rise to convection-currents of heated air, which render it difficult to secure satisfactory observations with any of the instruments.

At the time of Mr. Neison's report, the principal instruments of the observatory were: a fine eight-inch equatorial (by Grubb), the gift of Harry Escombe, Esq.; a high-class three-inch transit instrument, purchased by the government; an excellent sidereal clock, originally constructed for the Royal observatory, Greenwich, and at present lent by the Transit of Venus commission to the astronomer; and two chronometers, the one a sidereal, and the other a mean time. Mr. Neison describes these instruments, and reports their satisfactory performance. The observatory is at present without the usual equipment of meteorological instruments, but they will be obtained from England in the course of the spring.

Mr. Neison remarks upon the necessity of having proper steps taken for transferring in a regular manner to the Natal government the observatory and its site. It is built on ground originally assigned for a botanic garden, with the understanding that a sufficient space should be set aside for the purpose as might be deemed sufficient by the astronomer, though no written agreement to that effect was thought necessary. Owing to the nature of the ground, — a hillside covered with brush, — it is imperative that the astronomer (for the time in charge) should have every authority and complete control over the ground to the north and north-east of the observatory, which must be his chief observing-region; for otherwise he may be seriously hampered in carrying on his scientific work. The trees and other vegetation upon the surface of the ground have a far greater influence upon astronomical observations than in merely cutting off the view of a small portion of the heavens; this influence extending over the atmosphere for a considerable distance above them, owing to their liability to establish air-currents and tremors which are fatal to accurate observations. Experience has shown it to be not unfrequently necessary to clear the ground of particular kinds or groups of trees and shrubs, which establish such currents from being out of harmony in temperature and radiation-constants with the surrounding surface. Pines, laurels, and rhododendrons have had, on this account, to be removed from the environs of more than one observatory. Even the watering of the ground will give rise to most injurious convection-currents at times. When the moisture is general, as after a rain or heavy dew, it is of far less consequence; but when it is partial, as in watering plants, each plant sets up its own convection-current, and thus causes objects to appear most unsteady when seen through the air above, and so ruins accurate observation. Taking all things into consideration, Mr. Neison regards it as certainly most unwise to cramp the observatory and its future by confining the site set apart for its use to a smaller area than three hundred by seventy yards, both measured horizontally. A mere partial control or divided authority over this area, or any portion of it, would be unwise; for it would be sure to lead to complications and conflict of authority — if not in the immediate future, for a certainty at no long-distant date.

The Natal observatory has taken vigorous measures for the distribution of time-signals throughout the colony. At one o'clock every day a signal is sent to the central telegraph-office at Durban, from which it is distributed all over the colony, firing a time-gun and dropping a time-ball at Maritzburg, and also one at the Point, Durban. It is proposed to extend this system by the addition of a time-gun in the centre of Durban; to establish time-balls at Newcastle and Stanger; and, in connection with the Natal harbor board, to establish a system for properly regulating and rating ships' chronometers, similar to that already in existence at Liverpool and elsewhere.

In observing the transit of Venus the astronomers were moderately successful, no observations being undertaken outside of the usual optical ones. Copies of all the observations have been duly transmitted, through her Majesty's astronomer at the Cape, to the Transit of Venus committee at Burlington house, London.

With regard to tidal reductions, it has been arranged with the Natal harbor board that the tidal observations which are being made at Natal shall be reduced in the colony under the superintendence of the observatory, and proper tidal-tables constructed.

With reference to the future work of the observatory, it is proposed to take advantage of every opportunity for carrying out a series of observations of the moon, with a view of obtaining data for perfecting the tables of the motion of our satellite. The duty of making standard meridian observations of the moon is fully carried out at the Royal observatory, Greenwich, and partially at the Radcliffe observatory, Oxford, and at the U. S. naval observatory, Washington; but, for obtaining the full information necessary for properly discussing these observations so as to make them available for per-

fecting the theory of the motion of the moon, it is necessary that a considerable number of auxiliary observations should be made. These, it is proposed, should be made at the Natal observatory with the greater facility, as all the lengthy mathematical analysis necessary for their reduction has already been executed by Mr. Neison himself. The principal subjects already taken up at the observatory are the following: —

1°. The determination of the exact amount of the parallactic inequality in the motion of the moon by means of observations of the position of a crater near the centre of the lunar surface.

2°. The determination of the exact diameter of the moon by observations of pairs of points near the limb.

3°. The effect of irradiation and its variations upon the apparent semi-diameter of the moon.

4°. The systematic variation in the apparent place of the moon produced by the irregularities on its limb.

5°. The real libration of the moon by a method independent of the errors caused by abnormal variations in the apparent semi-diameter of the moon.

The first investigation is in continuation of the one already commenced at the Arkley observatory, England, and will be carried out with the additional co-operation of the observatory of Strasburg, Germany. Arrangements are being made to obtain the co-operation of the Cape and other observatories in the investigation of other of the above subjects.

ECONOMY OF FUEL IN IRON-MANUFACTURE.

As the price of iron falls, every item in the cost of its production is more and more carefully scrutinized, — the quality of the ore, the cost of transportation, the labor used at the various steps in the process, the accessories and mechanical appliances, the rapidity of working, the quantity of fuel to the ton of pig-iron produced, and the cost of the fuel. Of all these, the cost and quantity of fuel used are, perhaps, receiving the largest share of attention from the iron-men just at present.

One coal-saving device is the Gjers soaking-pit. Formerly the huge ingots of steel from the Bessemer converter were allowed to cool, and were again heated before rolling them into steel rails. The efforts to roll them while still hot failed, owing to the fact that the core might still remain fluid while the outside shell of the ingot was cooling even below the rolling-heat. The Gjers soaking-pit is a hole in the ground, walled with bricks, in which the ingot of steel is placed until it has uniformly cooled to the rolling-heat, thus saving the reheating-furnace. It is claimed that the Gjers soaking-pit saves sixty-seven tons of coal to a hundred tons of rails. Again: at the South Chicago works the pig-iron is run directly from the blast-furnace into the Bessemer converter; while the usual practice in most works has been, and still is, to allow the pig-iron to cool, and to melt it again in a special furnace for the Bessemer converter.

The above processes save in the *quantity* of fuel; while, on the other hand, a large saving in the cost of fuel is looked for in the improved methods of coking and in the recovery of the valuable by-products. It seems quite generally admitted, that a good system of coking, which will save the tar-oils and the ammonia, will pay all the coking-expenses.

The great national economy will be better understood from figures. In the year 1880, in the United States, 2,752,000 tons of coke were produced from 4,360,000 tons of coal by the old-fashioned beehive oven. Two years ago the figures for Great Britain were 7,000,000 to 8,000,000 tons of coke from nearly 13,000,000 tons of coal by beehive ovens. This quantity of coke could have been produced by the Simon-Carvès system of coke-ovens from 10,000,000 tons of coal; effecting a saving of 3,000,000 tons, and also a saving of the coal-tar and ammonia by-products.

The beehive oven, which takes its name from its form, is a low, square chamber with dome-shaped top; has an opening for escape of gases at the top, and a door in the side through which to admit the air, to charge the coal, and to discharge the coke. The burning is regulated by opening and closing the side-door, and all the gases go to waste at the top. The Simon-Carvès system of ovens consists of a row of chambers side by side, with combustion-flues in the parting-walls and under the floors. The waste-gases are burnt in these flues, and liberate heat enough to distil the gases of the coal. These gases, before entering the combustion-flues, are passed through condensing-apparatus, where the tar and ammonia by-products are saved. The two ovens, therefore, work upon totally different principles. The beehive cokes by slow combustion, sacrificing a portion of the coal by the door, as well as the by-products: the Carvès simply distils. The beehive saves 60 % to 65 % of the coal as coke: the Carvès saves 75 %. The beehive oven produces a very fine coke, in long, columnar, hard, silvery, porous masses: the Carvès gives a dark, dense, heavy coke. And it is here that the iron-master hesitates; for he likes the silvery, porous beehive coke for making iron, and does not yet accept the dense, heavy coke of the Carvès oven.

Jameson has invented an oven which is known by his name, and which is essentially a beehive oven, with a suction-pipe entering at the bottom instead of the roof-outlet for gases. The products of combustion are drawn by an artificial draught through the pipe; and, after being carried through apparatus for the condensation of the by-products, this gas is available for any purpose. The actual yield from a ton of coal has been estimated to be: sulphate of ammonia, 10 pounds; oils, 8 gallons; gas, 12,000 cubic feet; coke, 67 % to 69 %. The tar from this oven is lighter than water (specific gravity, .960), and consists mostly of oils, boiling between 250° and 300° C., of little value as burning-oils, and of secondary value as lubricants. Paraffine is present, and both toluine and xyline in small quantities, but no benzine. A portion of the oils breaks up into phenols, which, so far as investigated, give colors of little stability. Neither naphthaline nor anthracine is present, both valuable as sources

of coal-tar colors; and, while this tar presents an attractive field for research, it is not of great value at present. On the other hand, the tar from the Simon-Carvès has a specific gravity of 1.20, is black and thick, rich in naphthaline and anthracine, contains benzine, toluine, xyline, and carbolic acid, and is free from paraffines. A good deal of benzol is supposed to be carried off and burned. Now, Mellor has recently patented a process for extracting benzol from gas by passing it up through an earthenware tower filled with broken glass moistened with nitric acid. Davis has also a process for refrigerating gases. Either of these processes, added to the present plant of the Simon-Carvès, would save valuable products for coal-tar colors.

It is generally the fate of new improvements, that some unforeseen difficulty stands in the way of immediate adoption. In this case the dilemma seems to be, that the iron-men say, give us beehive or Jameson coke and Simon-Carvès by-products, and we will embrace the improvement at once. But, while the Jameson coke is good, the by-products are not as yet of much value; and, while the Carvès by-products are valuable, the coke is not yet satisfactory. Improvements often are adopted partially, or in some modified form. So it appears to be in this case.

The furnaces at Gartscherrie, near Glasgow, Scotland, have for years been smelting with raw coal, allowing it to coke itself at the top of the furnace, thus losing all the by-products, and some of the coal itself. They have recently tried closing in the top of two of these furnaces, and conducting the furnace-gases through condensing-apparatus on the way to the boilers, hot-blast stoves, etc. They have been so much pleased with the result of the experiment, that they propose to apply the same improvement to the other eight furnaces. This arrangement will probably yield a much heavier oil than the Jameson oven, but perhaps not so heavy as the Simon-Carvès; and, as the coke is made within the furnace itself, it is hard to say just what its quality may be.

Report says that modified plans are being tried in still another way, and that the highly bituminous coals of Colorado are treated by a process of coking; and the derived gas is injected into the blast-furnace, and thus re-enforces the heat of the coke, which is mixed with the ore, as usual, and has thereby effected a reduction of 75% in the cost of the smelting.

R. H. RICHARDS.

THE FLORA OF LABRADOR.

THE list of the plants of Labrador published in the Proceedings of the U. S. national museum, vol. vi. pp. 126–137, is interesting as showing some facts of geographical distribution. Though the list makes no pretensions to being complete, still it may be considered that it represents the flora in a sufficiently complete form to allow inferences to be drawn from it.

There are enumerated, altogether, a hundred and sixty-one species and varieties. Of these, two, Ranunculus acris and Capsella bursa-pastoris, have been introduced from Europe. Of the hundred and fifty-nine left, a hundred, or nearly sixty-three per cent, are natives of Europe as well as of Labrador. Out of these hundred species, there are some having a more northern distribution than Labrador, and a few extend even to the Arctic circle. Many of them are marsh or swamp plants, or else live along the seacoast. The flora, as a whole, is most decidedly northern in its character.

Of the fifty-nine species not known to Europe, it is found that thirty-eight have a range to the northward of the 49th parallel, and that only about four (viz., Fragaria Virginiana, Kalmia latifolia, K. angustifolia, and Alnus serrulata) can be considered as southern forms. Of these, the first is 'rather rare,' the two Kalmias are found in 'ravines and near ponds in the interior,' while the last is found 'in ravines' and along the seacoast. The northern aspect of the flora is further illustrated by the following facts:—

The Ericaceae, an order most abundant in cold climates, has seventeen species; Rosaceae has eighteen species, ten of them belonging to the northern genera Potentilla and Rubus; Caryophyllaceae has eleven species and varieties; while the Labiatae has not a single one, the Borraginaceae has only one, Scropulariaceae but two, and Compositae is sparsely represented by four.

This last seems an especially striking fact, and is in accordance with what we might expect. We know that the order is largely a tropical one, and that probably the heat of the summer months in Labrador is not sufficient, and not long enough continued, to enable the plants to flower and fruit. Of the Leguminosae, there are only five species, four of them being European also; and this order may be regarded as being in the same category as the Compositae.

In a former article (Indigenous plants common to Europe and the United States, *Journ. Cinc. soc. nat. hist.*, iv. p. 51), I have endeavored to show that we must look to the north as the place of origin of many of our plants; and when we find that sixty-three per cent of Labrador plants are also European, and twenty-three per cent have a high northern range, some extending to Alaska and Greenland, we see further reason for the assertion. That many of these plants were at one time distributed all around the Arctic circle, there can be no doubt; and that they have been driven from their first homes by the excessive cold, and found suitable abiding-places at the south, must also be considered as an established fact. The agent in this pushing-southward of northern forms may be regarded as the glacial period, when the presence of the immense mass of ice on the continent caused the flora to continue to retire farther and farther south as the cold became more and more intense: when it mitigated, many of the plants returned north, and established themselves as near as they could to their original homes.

JOS. F. JAMES.

THE HALL PHENOMENON IN LIQUIDS.

Professor Antonio Roiti publishes (Atti acc. lincei, xii. 397) under the above title the results of some experiments he has made. In preparing himself for his work, he repeated some of the ordinary experiments upon this phenomenon in metals: and the results, which contain nothing new, are shown in several diagrams. He devised one new experiment, however, which shows, as he thinks, that the effect he is investigating is not due to a direct action of the magnetic field upon the electric current *per se*. As the opinion thus reached by Professor Roiti must have been held two or three years by all who have given special attention to the matter, it is hardly worth while to inquire whether his new experiment is conclusive in itself.

In experimenting with liquids, Professor Roiti was unsuccessful in his main object, no effect similar to the well-known action in metals being detected.

It did appear, however, that the magnet, acting upon a solution of sulphate of zinc of given strength, was able to produce a change in the electric conductivity of the solution, the sign of which depended upon the direction of the magnetic force, the current in the liquid, and the degree of concentration of the solution. Thus, in a solution less concentrated than that which possesses the maximum electric conductivity, the effect was in a certain direction; while the opposite effect was produced, under the same conditions of current and magnetic force, in a solution having a concentration greater than that corresponding to this maximum. In a saturated solution no similar effect was observed.

Professor Roiti attributes this behavior of the non-saturated solutions to a want of homogeneity in the liquids, which become stirred up by the ponderomotive electromagnetic action. He makes several experiments tending to support this opinion. In a solution of ferric chloride (*cloruro ferrico*), of specific gravity 1.34, effects were obtained similar to those found with the dilute solution of sulphate of zinc. In a thin layer of mercury no similar effect was detected.

The examination of liquids with the view of detecting a 'rotational effect' similar to that observed in metals was probably first suggested in print by Ettingshausen.[1] The difficulties of the investigation were obviously great, however; and Professor Roiti appears to be the only experimenter who has yet undertaken it.

His account of his experiments is open to criticism in this respect: that it does not give sufficient data in regard to intensity of magnetic field, etc., to enable the reader to determine how severely the liquids were tested for the presence of the effect which gives the title to his article.

Moreover, he seems to have made a point of placing his side-connections unsymmetrically, so as to have, independently of the magnet's action, a considerable 'derived' current, — an arrangement which enabled him to discover the effect described above, but which, on that very account, should be studiously avoided in seeking for the phenomenon he was trying to detect.

Professor Roiti's ultimate object in beginning this investigation was to determine whether the transverse or 'rotational' effect would in liquids correspond to the magnetic rotation of the plane of polarization of light. Of course, no conclusion whatever upon this point can be drawn from the account given of his work and its results. And, even if his experiments had been entirely successful in revealing the effect looked for, it would be necessary to exercise caution in applying results so obtained to the case of the rotation of light. In the liquids, as here examined, the particles have time to fully adjust themselves, in position and motion, to the requirements of the magnetic force and the electric current to which they are subjected; while in the phenomenon of light, assumed to be electromagnetic in character, the mere inertia of the particles of the liquid must play an important part in the action of forces, which are reversed a countless number of times every second.

In the *Comptes rendus* of Sept. 17, 1883, Professor Righi states that he has found the Hall effect in bismuth to be of the same sense as in gold, but about five thousand times greater than in the latter metal. He obtains a very marked action in bismuth by use of an ordinary bar-magnet, and believes that he can produce a perceptible effect by the action of the earth's magnetism.

[1] *Anz. akad. wissensch. Wien*, March, 1880.

JANET'S THEORY OF MORALS.

The theory of morals. By Paul Janet. Translated from the latest French edition [by Mary Chapman]. New York, *Charles Scribner's Sons*, 1883. 10 + 490 p. 8°.

If books on ethics are to be noticed at all in a scientific journal, they might be, as a rule, safely classified under the head of fossils. No literature deals with a subject which would seem to be more living; yet no literature is, on the whole, more desiccated and dead. Human conduct, with all its infinite variety of standards and impulses, with all its marvellous interworking of passions and emotions, with all its pressing and personal problems, conflicts, and obligations — what subject would seem to stimulate students to greater vividness, picturesqueness, or incisiveness of treatment? Every man is in his own way an ethical philosopher. No one can escape thinking about the right principles of his conduct. Books on this subject address the largest possible audience on the one unavoidable subject of reflection. And yet there seems to be some subtile influence which dries up even literary instincts when they approach this theme and which makes even brilliant writers wearisome. There

is hardly any living English writer more abounding in vitality and wit than Mr. Leslie Stephen; but even he, when he enters this enchanted region, seems benumbed and drowsy, and is positively hard to read. There is said to be no American teacher who has imparted more moral force to his students than the venerable president of Williams college; but, the moment he arranges his instruction in a book, it is as if he gathered his living flowers from useful and from noxious plants, and laid away these virtues and vices, all pressed and juiceless, in successive drawers.

The last work of Janet, which he frankly describes as his *Magna moralia*, is certainly as little open to these criticisms as any book of its kind. It attracted much attention on its first appearance in 1874, and was for some years used as a text-book in Harvard college. It is now translated, and very well translated, for the use of President Porter's classes in Yale college. It has lucidity, as our last literary adviser would call it, and is full of learning. Its strength lies where the German masterpieces are weakest, — in force and variety of illustration. It is hardly extravagant to say that so clear and picturesque a treatise, in the hands of an alert teacher, might save the study of ethics from its almost inevitable fate of being very dull.

The stand-point of the author may be very briefly described. He is a conspicuous instance of the many minds who desire to be eclectics, but whose hearts will not permit them. He sees that the problem of ethics, like that of all present philosophy, is a problem of reconciliation. He sets himself to comprehend in his system the whole range of contributions to ethics made by modern utilitarianism, but he is none the less at heart a Kantian. The moral law of Kant appears to him too formal, too abstract, too empty, and he is repeatedly offering corrections and supplements; yet if Fichte is a disciple of Kant, so, in spite of frequent controversy with the master, is Janet. His first thrust is at the least-guarded part of the experiential method, — its incapacity to distinguish between quantity and quality in conduct. Here he discloses with ease the contribution which Mr. Mill has made to the view of conduct which he believed himself to be opposing; and we pass from the recognition of this distinction of quality in acts to the principle which alone can give quality to them. This principle he defines as their intrinsic excellence; and this excellence, in its turn, is to be judged by the contribution of acts to the unfolding of the best in man, — of his real personality, his reasonable will. Thus we find before us the moral dynamic of a completed life, the conception of an end in which happiness and excellence shall coincide, — in short, a moral ideal. This discussion occupies the first of three divisions in the treatise. The two remaining books unfold this fundamental conception in its relation to outward standards of duty and to inward laws of life. They proceed with great clearness and almost with vivacity of treatment, and invite us in somewhat fragmentary fashion to a great variety of problems, both of metaphysics and casuistry, which we cannot here consider.

Returning to the main contribution of the book to the theory of morals, the present reviewer has no controversy to undertake with its evident purpose. The ideal aim which it presents is not stated with the frankness of Grote, or with the fulness of Green; yet it is as plain with Janet as with Grote, that man is essentially 'an ideal-making animal,'[1] and as certain, though not so plain, with Janet as with Green, that the development of the moral ideal is a personal and inward, and not a social, evolution.[2] What we shall here with some diffidence suggest, however, is the highly technical character of all these treatises, and, indeed, of the whole range of ethical literature. We repeat the impression with which we began this notice. Here is a subject which deals more directly than any other with the real and daily relations of life; yet, as we have just now tried to describe the purport of a remarkably lucid book, we have found ourselves forced into the language of specialists, and away from the methods of practical affairs. It is quite possible for a man to be a highly trained moral philosopher, and yet be a powerless adviser concerning a specific moral problem, so far removed has been the science of right conduct from the subject with which it is supposed to deal. Now, we maintain that a science of life should frankly take its start from the data and the problems of life, and should proceed inductively to analyze and classify these data, and to discover what may be their law. The literature of moral conduct may be at present divided into two distinct classes, — the books which deal with theory, and the vast and rapidly growing literature which deals with the practical conduct of social life. This latter department is largely the growth of the last few years. It may be called ethical sociology. It describes the duties one owes to himself and to society, — the duties, or, in the case of Pro-

[1] Grote on moral ideals, p. 46, ff.
[2] T. H. Green, Prolegomena to ethics, 1883, pp. 189, 201.

fessor Sumner's little book, the absence of duties, between social classes; the problems of charity, temperance, and all the varied aspects of moral reform. Now, between these practical applications of ethics and the books on ethical theory there lies an unbridged chasm. The maxim of Kant gets ample illustration: "Ideas without content are empty; observation without ideas is blind." [1] When sociologists approach any theory of morals, they exhibit an almost ludicrous ignorance, as when Professor Sumner interprets sympathy in the spirit of unconscious Hobbism. When, on the other hand, a student of the metaphysics of morals approaches a problem of practical conduct, he is apt to find his law unmeaning. Here, then, it would seem, is an opportunity for what may be fairly called inductive ethics. It is not the method which commonly claims this name, and which simply means the exclusion of any evolution of personality; it is the construction of a theory of ethics from an examination of the facts of social life, the data of philanthropy, the testimony of ideal aims, the characteristics of moral personalities. This would be a method of ethics which would be constantly close to life, and which would gather up the real issues of conduct into their higher significance and tendency.

Francis G. Peabody.

BACTERIA.

Bacteria. By Dr. Antoine Magnin and George M. Sternberg, M.D., F.R.M.S. New York, *Wood*, 1883. 19+11+494 p., 12 pl., illustr. 8°.

This portly and handsome volume will be read with interest by all who have followed the painstaking and thorough work of Dr. Sternberg during the last three or four years. To him belongs the credit not only of having translated and published, in 1880, Magnin's useful book on the bacteria, but of having applied himself with tireless devotion and very considerable success to the actual work of laborious researches, often made under discouraging circumstances, and with little genuine sympathy from his fellow-countrymen. Dr. Sternberg is at the head of the American school of working bacteriologists, if, indeed, he is not its only member; so that any work coming from his practised hand should meet with a hearty welcome.

The present volume, which might well be called a handbook of bacteriology, is made up partly of Magnin's older treatise referred to above, and partly of new material supplied by Dr. Sternberg. Magnin's account of the morphology and the physiology of the bacteria, covering one hundred and fifty-two pages, is preserved intact. The rest of the older book is omitted; and in its place we have four 'parts' written by Dr. Sternberg, and discussing respectively, 'Technology,' 'Germicides and antiseptics,' 'Bacteria in infectious diseases,' and 'Bacteria in surgical lesions.' These, taken together, make up more than one-half the book.

Of Magnin's work it is not needful to speak. His book is familiar. We may turn, then, to the parts prepared expressly by the American author. Under 'Technology' we have a succinct but clear account of the various methods of collection, of cultivation, of staining and of photographing the bacteria, and of the attenuation of virus. Of most of them the author speaks from experience; and this chapter will be of the utmost value to the student and the investigator. Of course, in a subject like this, intricate and refined to the last degree, actual personal guidance is essential, or, at least, highly desirable; and we believe that Dr. Sternberg has given enough of the technology to help, but not enough to harm, the student.

Under the head of 'Photography' (p. 194) the author says, —

"It is but fair to say that satisfactory results can only be obtained by the expenditure of a considerable amount of time and money, as the work must be done with high powers, and the technical difficulties to be overcome are by no means inconsiderable. The illustrations in the present volume may be taken as fair samples of what may be accomplished, and it will be found easier to criticise these than to improve upon them."

The plates are, indeed, of an unusually high order; the heliotypes of human (yellow-fever) blood being something remarkable, and not likely to be improved upon at present.

Under the head of 'Germicides and antiseptics' we observe at the outset (p. 210) the following conspicuous finger-post: —

"If it were proven that the infectious character of every kind of infective material depended upon the presence of a specific living germ, as has been shown to be true in the case of certain kinds of infective material, *germicide* and *disinfectant* would be synonymous terms. Although this has not been proved, it is a significant fact that all of the disinfectants of established value have been shown by laboratory experiments to be potent germicides."

Numerous original experiments are here recorded; and the author agrees with the other authorities in giving little germicide value to most common disinfectants, and in pointing out the extraordinary efficacy of mercuric bichloride.

[1] Kritik der reinen vernunft, s. 81, ed. Hartenstein.

Besides a dozen or so of pages devoted to the *rôle* of the 'Bacteria in surgical lesions,' and having chiefly a medical interest, the rest of the book is devoted to a long and careful treatment of the 'Bacteria in infectious diseases,' and to the literature of bacteriology. These and the part on 'Technology' include the cream of the work.

At the start the author incidentally draws a subtle distinction, which may or may not be generally acceptable (p. 236), —

"The practical results of etiological studies, so far as the prevention and cure of disease are concerned, are likely to be much greater than those which have been gained by the pathologists;" —

adding directly in a tone of liberal conservatism, which no one can help admiring, especially as it comes from one who is in the advancing column, —

"and if the time ever comes, as now seems not improbable, when we can say with confidence, infectious diseases are parasitic diseases, medicine will have established itself upon a scientific foundation. But this generalization, which some physicians think is justified even now by the experimental evidence which has been so rapidly accumulating during the past decade, would, in the opinion of the writer, be premature in the present state of science. And for the present it seems wiser to encourage additional researches, rather than to attempt to generalize from the data at hand. . . . Those who have had the most experience in this difficult field of investigation are commonly the most critical and exacting with reference to the alleged discoveries of others."

Dr. Sternberg sees clearly enough that one of the most interesting theoretical questions in this whole subject which remains still unsolved is, how does inoculation or vaccination protect? or, in his own words, what is "the rationale of the immunity produced by protective inoculations? . . . Recovery, after inoculation with attenuated virus, is more easy to understand than is the subsequent protection" (p. 241).

Lecturers upon the subject often pass lightly over this point, and, by a comparison with a fermentation in a barrel of cider for example, say, "And just as a barrel of apple-juice can ferment but once under the same germ, so a man usually has the small-pox but once;" the idea being implied, that, as the alcoholic ferment has eaten up its food in the barrel, so the hypothetical small-pox plant has taken out all the available food-material from man, its living prey. Pasteur maintains a position like this; while Sternberg denies that it is a satisfactory explanation, and brings forward a lengthy argument in opposition, some of the points of which do not seem to us well taken. It is, however, the sufficient and fatal objection to the line of thought outlined above, that, while the barrel of apple-juice is a not-living medium, the living organism is undergoing constant repair, is even growing (in the technical sense) till death comes, and is therefore no fixed quantity, either in composition or condition. Dr. Sternberg would solve the problem by considering the acquired protection to be a 'tolerance,' a 'resistance' of the protoplasm to the new condition; e.g. (pp. 248–249), "during a non-fatal attack of one of the specific diseases, the cellular elements implicated, which do not succumb to the destructive influence of the poison, acquire a tolerance to this poison."

This would explain a temporary immunity, — would prevent a patient from 'giving' the disease to himself over and over again, — but would not explain a lifelong immunity, since new, and perhaps non-tolerating, non-resisting cells are being constantly produced from the old ones. The cells which actually suffered are therefore supposed by Dr. Sternberg to "acquire a tolerance to this poison, which is transmissible to their progeny and which is the reason of the exemption of the individual from future attacks of the same disease."

This hypothesis is certainly clear, and it is only befogged by the author's illustration (?) drawn from budding and grafting.

In view of the fact that bacteria are now believed to do their work largely by producing a genuine not-living poison which affects the living cells, the following is of interest: —

"The tolerance to narcotics — opium and tobacco — and to corrosive poisons — arsenic, which results from a gradual increase of dose, may be cited as an example of acquired tolerance by living protoplasm to poisons which at the outset would have been fatal in much smaller doses.

"The immunity which an individual enjoys from any particular disease must be looked upon as a power of resistance possessed by the cellular elements of those tissues of his body which would yield to the influence of the poison in the case of an unprotected person."

The reader must recollect, however, Huxley's discussion of 'aquosity' and 'horologity,' and remember that in such sentences as the following we are doing little more than formulating our ignorance: —

"The resistance of living matter . . . is a property depending upon vitality."

The question is often raised, Where do the pathogenic bacteria come from? Dr. Sternberg says in this connection, —

"If we suppose that under certain circumstances the conditions relating to environment approach those which would be found within the body of a living animal, we can easily understand how a micro-organism which has adapted itself to these conditions

may become a pathogenic organism when by any chance it is introduced into the circulation of such an animal. The culture fluid — blood — and temperature being favorable, it is only a question of superiority by vital resistance on the one hand, or by reproductive activity on the other.

"That harmless species of bacteria may develop pathogenic properties in the manner indicated seems extremely probable; and we should *a priori* expect that such a result would occur more frequently in the tropics, where the elevated temperature and abundance of organic pabulum furnish the favorable conditions required. In this way we may, perhaps, explain the origin of epidemics of pestilential diseases, such as yellow-fever and cholera. If these diseases do not at the present day originate in the manner indicated, they, at all events, have their permanent abiding-place in tropical countries."

Much space is properly devoted to the status of science regarding the individual diseases, and the treatment of them by the author is highly satisfactory. The volume closes with an admirable literature of the subject, for which all students will thank him. But in another edition he should add information as to where the papers of E. C. Hansen can be found. It would be better, also, to give the titles of German papers throughout in the German; and it surely is as needful to mention Schwann and Kützing as Cagniard de Latour, while the failure to record the translation of Schützenberger's work is a serious omission. Aside from these and other insignificant and pardonable errors, the bibliography is very satisfactory. The alphabetical arrangement which has been wisely adopted has one slight disadvantage: we miss the striking evidence of the growth of the subject, which a chronological arrangement such as was employed in the translation of Magnin's book in 1880, and which was in this respect impressive, gave.

On the whole, this book is the most practical, the most complete, and the most useful which we possess upon the subject. It is both a storehouse of principles and a handbook for the laboratory. If a physician or a student, a biologist or a pathologist, can have but one book, this one, because of its lucidity of style, its cool, cautious tone, its breadth and yet its comprehensiveness, and particularly because of its excellent illustrations, is emphatically the one to get. It is deeply to be regretted that Dr. Sternberg cannot be kept busily at work under every favorable condition at the expense of a country to whose service his life has been devoted, and that he is, on the contrary, obliged to write sentences so melancholy as these: —

"All this is admitted, and the experiment is introduced mainly to call attention to a method, which, carefully applied, should enable us to solve the question as to the pathogenic *rôle* of this micrococcus. The writer had mapped out for himself a series of experiments in this direction, and many others relating to etiological questions; but circumstances have not been favorable for the prosecution of experimental work, and he finds himself, somewhat reluctantly, engaged in a review of the field, when it would be far more to his taste to interrogate nature by the experimental method, and thus to aid directly in the solution of these interesting problems" (p. 447).

SCIENTIFIC LINGUISTICS.

Internationale zeitschrift für allgemeine sprachwissenschaft. Herausgegeben von F. Techmer. Heft i. Leipzig, *Barth*, 1884. 16+256 p., 7 pl., illustr. 8°.

This new journal appears with an excellent though only partial list of contributors, representing various nations and languages. The articles may be in German, English, French, Italian, Latin, and, under exceptional circumstances, even in some other language; and the international character it is meant to have is perhaps the best justification for its existence. The editor, Dr. Techmer, *privatdocent* at Leipzig, has previously published a work on phonetics; and the most noteworthy article in this number is one by him on the same subject. Most, if not all, of the other articles might well enough have been published in already existing journals. They are all in German, except two in English (together occupying some twenty-two pages out of over two hundred and fifty) and one of about four pages in French. The writers are Pott (Einleitung in die allgemeine sprachwissenschaft), Techmer, G. Mallery (Sign-language, largely a reprint), Friedrich Müller, Max Müller (a short article in German on a Vedic name which he supposes to be identical with our word 'zephyr,' and to have been originally a name for the setting sun, zephyr meaning the west wind as coming from sunset), L. Adam (De la catégorie du genre), Sayce (The person-endings of the Indo-European verb), and Brugmann.

Techmer has two articles, — one devoted to the analysis and synthesis of audible speech; the other, to the transcription of sounds; both accompanied by illustrative figures and tables. The former is intended to give briefly what is known on the subject, and to add new contributions. The treatment of vowels is what is likely to interest phoneticians most in this latest work on the subject, especially its position with regard to the English school. It must occasion surprise, not that the English system is rejected, but that the arguments against it are so brief and insufficient; hardly any thing but Bell's work being considered, while

others, who have considerably modified Bell's system, are practically ignored. Sweet ought to have received careful attention; and Sievers surely deserved more than a curt footnote saying that the first edition of his book on phonetics had treated better than the second a certain class of vowels. The vowels meant have not yet been fully observed, but the Russian *jery* is one of them. Observations made several years ago in Leipzig, and renewed very recently in Boston by the writer of this notice, on the sound in question as pronounced by native Russians, are decidedly opposed to the theory accepted by Techmer; and Techmer's own hardly seem to favor it. That theory assumes that the sound is produced by *u*-position of the tongue, and *i*-position of the lips, while the English system makes it a vowel formed with the tongue in the 'mixed' position. In the present state of vowel-analysis, a correct account of this sound is of great importance, and vowels of the same class form one of the most marked features of the English scheme. Now, Techmer himself says he has only been able to observe a special form (*spielart*) of this class of vowels; namely, the Russian sound : and this he marks as formed with partially passive lips, like English vowels, and (sometimes only?) with an approach toward *mittlere zungenartikulation*. This comes very near the English description of the sound. The whole of Techmer's article is less clear and less interesting than Sievers's work, and makes the impression of resting more on theory than on unprejudiced observation of actual speech. To put, for example, *a* in the centre of the vowel-scheme must seem to many phoneticians a fundamental error. Still, the article contains much that is valuable, and is not to be neglected.

The second article, that on the graphic representation of speech-sounds, is open to objection for the same reasons. The account of English *e* in *err*, and *u* in *but*, certainly needed justification. They are represented as somewhat incomplete varieties of a sound to be classed with German *ö* and *ü*, — a statement which can only be accepted by one who agrees with Techmer as to the place of *a*, if, indeed, by any one. Also the English and American *r* sound ought to have been carefully distinguished from the rolled or trilled *r*'s, as Sievers has done.

If the journal lives, it will certainly contain much valuable matter. It is only to be feared that its rivalry will injure others already established, such as Kuhn's *Zeitschrift*.

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

GOVERNMENT ORGANIZATIONS.

Geological survey.

Division of the Pacific. — This division includes those parts of California, Oregon, and Washington Territory the drainage of which flows to the Pacific Ocean. An exception is the Lewis Fork of the Columbia River, which rises within the limits of the Great Basin.

The work undertaken in this division is divided into two classes; viz., the investigation of the mining-industries, and the study of the volcanic rocks. As preliminary to the latter, topographic work has been carried on for two seasons in northern California. Some of the details of this work, in the vicinity of Mount Shasta, have already been published.

Examination of quicksilver deposits. — Mr. George F. Becker and his assistants have been engaged in an examination of the quicksilver deposits of California. During the season of 1883 Mr. Becker's personal attention has been devoted to investigations in the vicinity of Sulphur Bank. In August a trip was made to the North Fork of Cache Creek and to Lower Lake, the only localities in that section where fossiliferous strata occur. The latter part of August and early part of September were spent in this section in order to complete the map of the Clear-Lake region of California. Returning to Sulphur Bank, soundings of the lake were taken, and the final examinations of the mines made, after which the party returned to San Francisco to prepare for the winter's office-work.

In the New Idria district, topographic work in connection with Mr. Becker's work was carried on throughout the whole season by Mr. Hoffmann. The survey was made with the utmost care, and in great detail. Contour lines, eighty feet apart vertically, were run; and intermediate forty-foot contours were interpolated by means of slope-measurements in the steeper parts, and by running curves in the more level portions. The entire area surveyed includes twelve square miles, and the field-work for the map was completed early in 1884.

Geologic work. — Mr. Turner, under the direction of Mr. Becker, undertook an examination of the region in the vicinity of Knoxville, after a trip from Clear Lake to the latter point, during which, notes on the general geology of the line of travel were taken. His work was interfered with by sickness, which obliged him to enter the hospital at San Francisco for treatment. Later in the season, however, he returned to the field, and throughout January, 1884, was busy mapping the formations in the region about Knoxville.

Laboratory work. — Dr. Mellville, in the laboratory at San Francisco, has been busy with analyses of the minerals, rocks, and waters collected at Sulphur Bank, and with other analytic work in connection with the examinations of the quicksilver deposits. He and Mr. Becker have been investigating some of the chemical relations of quicksilver.

Study of the volcanic rocks. — Capt. C. E. Dutton has been placed in charge of the investigation and study of the volcanic rocks in this division, with Mr. J. S. Diller as assistant. Capt. Dutton, during most of the past season, was busy in the preparation of his memoir on the Hawaiian volcanoes, which will be completed in time for publication in the fourth annual report of the director. Owing to the as yet incomplete state of the topographic work (which is progressing satisfactorily under the charge of Mr. Gilbert Thompson) in northern California, the field geologic work has been confined mainly to preliminary reconnoissance work, which has been carried on by Mr. J. S. Diller. Mr. Diller and his assistants took the field at Red Bluff, Cal., early in July, and immediately began work in that vicinity. The plain east of Red Bluff is a volcanic conglomerate of andesitic basaltic fragments of tufa. This formation is apparently of great extent, and reaches to the eastward for twenty-five miles. Late in July the party left Red Bluff, after having made a trip of six days' duration to Lassen's Peak, and proceeded *viâ* Redding to Yreka. From this point the ascent of Mount Shasta was made, after which they went to Linkville, Ore., taking the valley of the Klamath River to cross the main platform of the Cascade Range. Mr. Diller spent some time in the region of Mount Scott and Crater Lake, the geological features of which he found especially interesting. A brief but careful examination was made of the valley which the Klamath River cuts across the Cascade Range, in order to ascertain the geologic structure of that mountain platform. Interesting studies were also made of the faults and dislocations on the eastern side of the range, near Klamath Lake. The work thus detailed kept the party busy during August; and during September the reconnoissance along the eastern side of the range was continued. Union Peak, Mount Thielson, Crescent and Summit lakes, and Diamond Peak were all visited. From the latter Mr. Diller proceeded to the group of volcanic cones known as the Three Sisters, where both Mr. Diller and his assistant, Mr. Hayden, met with the accident already noted, which obliged them to suspend work temporarily. Later on, however, the work was continued to the northward. An account of the return trip to Red Bluff, *viâ* the western side of the Cascade Range, has been already given in *Science*. The entire trip occupied a hundred and eleven days, and the distance travelled was twenty-five hundred miles. The work done will be of great service in the determination of many of the problems connected with the range, and will form an excellent basis for future field-work. Mr. Diller is of the opinion that a special study of Lassen's Peak, if made before the detailed examination of the Cascade Range is begun, will be of great service. He says, no other ancient volcano in the United States is known that has erupted such a variety of lavas, or placed them in so favorable a position for study of their succession, as has Lassen's Peak. The solfataric phenomena at 'Bumpass' Hill,' and other places in the vicinity of Lassen, are much more extensive than at any other point in the Cascade Range. The region is also readily accessible. To the northward and southward, there are good exposures of the rocks which form the foundation of the Cascade Range, whereas north of Mount Shasta the exposures of these rocks are limited.

RECENT PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Appalachian mountain-club, Boston.

March 12. — The following resolution was adopted by the club: holding in high esteem the geographical labors of the late Professor Arnold Guyot, be it resolved, that the Appalachian mountain club is impressed with the loss it is now called to sustain in the death of an honored and illustrious member, and that the club receives with gratitude that rich store of knowledge his researches have disclosed to those who seek the truths of nature among the Appalachian Mountains. —— A paper on mountain adventures by Mr. Alessandro di Placido, including a winter ascent of Fujiyama, Japan, and one by Dr. S. Kneeland on a visit to the crater of Vesuvius at night, in April, 1882, were read. —— Mr. C. H. Ames described the mountains around the Ktaadn iron-works in Maine. This group consists of thirty-one peaks, ranging in height from fifteen hundred to four thousand feet, the highest being White Cap. Mr. Ames exhibited a beaver-skin, moose-antlers, and a reindeer-head. —— Mr. W. M. Davis, representing the U. S. geological survey, explained the proposition which the survey has made to this state for the production of a map, and the following resolution was passed: resolved, that the Appalachian mountain club, in view of the great insufficiency of the existing maps of Massachusetts, recognizes, in the proposal recently made to the legislature by the U. S. geological survey, an opportunity to obtain a topographical map of the state which should not be lost, unless the legislature is prepared to inaugurate a more thorough and expensive plan.

Linnaean society, New York.

March 7. — The following officers were elected for the ensuing year: president, E. P. Bicknell; vice-president, Dr. A. K. Fisher; recording secretary, L. S. Foster; corresponding secretary and treasurer, N. T. Lawrence. —— Mr. E. P. Bicknell read the con-

tinuation of his paper, 'A study of the singing of our birds,' the first instalment of which has appeared in *The auk*. The portion of the paper read consisted of a consideration of the arrival, departure, and song periods, with their duration and lapse, of thirty-eight birds. His observations were made at Riverdale, N.Y. —— A paper was presented by Dr. C. Hart Merriam, giving a life-history of the woodchuck as he had found it in the Adirondack region; recording its change of abode from the meadows to the edges of the woods as the hibernating-time approached, its weak attempts at tree-climbing, its almost total abstinence from water, the rare exercise of its swimming-powers, its occasional evidence of carnivorous propensities; and closing with an extract from the laws of New Hampshire that offer a bounty of ten cents for each woodchuck destroyed in that state. Dr. E. A. Means stated that about two per cent of the Adirondack woodchucks were melanistic. —— Notes concerning a few early spring birds were given by Mr. N. T. Lawrence; and Mr. William Dutcher spoke of the recent capture of a fine female Archibuteo lagopus Sancti-Johannis in black plumage on Long Island. —— Mr. E. P. Bicknell mentioned the blooming of those early spring flowers, the skunk-cabbage and the golden saxifrage, at present at Riverdale, N.Y.

Cincinnati society of natural history.

March 4. — Mr. Charles Dury read a paper on North-American hares, with notes on the peculiarities and distribution of all the known species and varieties. He said that in Kansas and Colorado the common prairie hare, Lepus campestris, is commonly though erroneously called the jackass-rabbit. The true jack-rabbit, L. callotis, has a more southern range. A skin of a specimen shot by Mr. Dury in New Mexico was exhibited. He had measured tracks of this hare which were twelve feet apart. The flesh of L. callotis Mr. Dury found to be very coarse and unpalatable. Not so, however, that of the little sage hare, L. Nuttalli, which was very good, providing the animal be drawn immediately after being killed. If the intestines are allowed to remain for even half an hour, their contents give the flesh a sagy flavor. —— Prof. Joseph F. James read an abstract of notes on some plants of the vicinity of Cincinnati. He exhibited a series of specimens of Cardamine (Dentaria) laciniata and C. (Dentaria) multifida, which showed that the two species could not be separated, and should be included under one specific name. —— Mr. Davis L. James read a notice of Mr. Thomas W. Spurlock, a botanist of local reputation, — a sort of Tam Edwards, who followed botanical pursuits from a pure love of them, and who, by his liberal distribution of rare specimens, and by his simple and child-like love for flowers and plants, had laid collectors under many obligations, and made his memory dear to them.

Engineers' club, Philadelphia.

March 1. — Mr. William Ludlow described tests of the crushing-strength of ice which were made by him in order to learn approximately the strength required for an ice harbor of iron screw-piles, in mid-channel, at the head of Delaware Bay. Eighteen pieces were tried with government testing-machines at Frankford, Philadelphia, and at Fort Tompkins, Staten Island. The specimens were carefully prepared six-inch and twelve-inch cubes, and roughly cut slabs about three inches thick, of different qualities and from different localities. For pure Kennebec ice the lowest strength obtained was three hundred and twenty-seven pounds, and the highest a thousand pounds, per square inch. For inferior qualities the strengths varied from two hundred and thirty-five to nine hundred and seventeen pounds. The higher results were obtained generally when the air temperature in the testing-room was from 29° to 36° F., as against 55° to 68° F. for the lower results. The pieces generally compressed half an inch to an inch before crushing. —— The secretary exhibited for Mr. C. A. Ashburner a set of blue prints of some yet unpublished details of the Chicago cable railways. —— The secretary presented a note, by Prof. W. S. Chaplin, upon a prevalent error in data given for determining the true meridian, by observing the instant at which Polaris and Alioth come into the same vertical, and then following Polaris for a *certain time*, at the expiration of which it is said to be on the meridian. He gives as the true time the following: latitude 40°, 25 m. 36 s.; latitude 50°, 25 m. 24 s.; latitude 60°, 25 m. 5 s; latitude 70°, 24 m. 29 s. —— Mr. C. J. Quetil exhibited models of the wire truss recently described by him. —— Professor Mansfield Merriman presented a statement of the progress of the triangulation carried on in Pennsylvania by the U. S. coast and geodetic survey.

Academy of natural sciences, Philadelphia.

Feb. 28. — Dr. Joseph Leidy directed attention to some parasitic worms, which included specimens of supposed leeches from the mouth of the Florida alligator. Herodotus states that the crocodile of the Nile had the inside of his mouth almost beset with leeches. The truth of this assertion has been confirmed by modern zoölogists, the species being the Bdella nilotica. The Florida specimens are, however, not leeches, but pertain to a species of Distoma or fluke, apparently not previously described, for which the name Distoma oricola was proposed. Of several Filariae, or thread-worms exhibited, two, a female and a male, belong to the species Filaria horrida. The former is twenty-eight, and the latter eleven, inches long. They were obtained from the thorax of the American ostrich. Other specimens were found in the abdomen of the marsh-owl. Two species of thread-worm have been previously observed in the bodies of owls, to neither of which the specimens under examination appear to belong. They so closely accord, however, with the descriptions of another species, Filaria labiata, infesting the black stork of Europe and northern Africa, that, notwithstanding the remote relationship in the host, the speaker believed them to belong to that species. —— Dr. N. A. Randolph spoke of the changes which occur in milk during boiling. Although but little difference can be detected by the unaided senses between raw and boiled milk, it was well

known, that, during the process of boiling, certain gases are given off; and the behavior of the fluid afterwards, under certain reagents, is different from that in its original state. If rennet be added to boiled milk at the temperature of the body, no change occurs for some hours; while, if added to raw milk, coagulation takes place rapidly. If diluted acid be added to boiled milk, it produces immediate coagulation; but, if mixed with the raw fluid, coagulation takes place much less rapidly. If alkali be added to the former, cream arises with rapidity and completeness, while no marked change occurs when it is added to the latter. Observations made, of forty-six specimens of gastric contents obtained from six men fed on milk, established the fact that unboiled milk had slightly the advantage as a nutrient, being somewhat more digestible than when boiled. Peptone was found to be present at all stages of digestion. His observations on the effect of rennet confirmed those of Schreiner, published some time ago in Munich. —— A communication was read from Miss S. G. Foulke on the structure and habits of Manayunkia speciosa, the fresh-water worm recently described by Professor Leidy. Miss Foulke has had an opportunity of studying mature specimens, and has consequently been able to make important additions to Dr. Leidy's account of the species, which was based on young specimens.

NOTES AND NEWS.

A GENERAL meeting of the American forestry congress will be held at Washington, D.C., on May 7. Time and place have been chosen contrary to precedent, in order to find an opportunity of calling attention to the society's active work, and impressing upon Congress, then assembled, the needs and requirements of forestry in this country. It is therefore desirable that such meeting should be well attended; and no individual efforts should be spared by the members and friends of this association to make the same particularly interesting and effective. The following subjects have been selected as leading topics of discussion, referees having been appointed to prepare papers in regard to them: Value of American timber-lands; Management of timber-lands and timber in Canada, and legislation thereon; Value and management of government timber-lands; Best method of planting trees on unoccupied government lands; Influence of forests on climate and health; Insects injurious to trees, causes and dangers of their excessive multiplication, and how to meet them in their wholesale ravages; Growing forests from seed by farmers; Preservation of forests on head waters of streams; Planting of trees by railroad companies; Irrigation in connection with tree-planting; Experiment-stations and forest-schools; How can we best promote the interest in, and knowledge of, forestry among all classes of this country?

— The yearly meeting of the Russian geographical society was, as usual, largely taken up by the report of the secretary about the yearly work. Nothing of special interest, not yet known, was included. In the yearly award of the medals which followed, the greatest gift of the society, the Constantine medal, was given to N. A. Sewertzow, the celebrated zoölogist and explorer of central Asia, for his lifelong work. The great gold medals of the sections of ethnography and statistics were not awarded this time. The Lütke medal was given to H. A. Wild for meteorological works. Four gold medals and a considerable number of silver and bronze ones were also awarded.

At the February meeting of the society a communication was received from Bukharow, Russian consul at Hammerfest, Norway, about his extensive travels in the Lapland peninsula in the fall of 1883. The fourth number of the society's *Izviestiya* has been issued. It contains, besides matter mentioned here, Konshin's account of the Kara-Kum sands in central Asia, and Vasenew's travels into western Mongolia.

— At a meeting of railroad engineers in Moscow in December, 1883, the establishment of meteorological stations at the railroad-stations, and of weather-telegrams sent by the railway-wires to Moscow, so as to be able to get information about the state of the weather, and predictions of events of interest to railroads (as snow-storms, heavy rains, and sudden thaws), was proposed. A meeting of the railroad boards, held soon after, agreed to this proposal; and so it is to be hoped Russia may soon have a system of observations by properly paid and controlled men, instead of relying entirely, as now, on unpaid and voluntary observers.

— A call has been issued for a meeting of inventors and persons interested in the perpetuation of the present system of U. S. patent-laws, to be held at Music Hall, Cincinnati, March 25, 26, and 27. The call is signed by gentlemen from twenty states, and delegates are expected from thirty-two states. Arrangements are being perfected for a probable attendance of three thousand.

The first object of this meeting is to effect a permanent organization for the purpose of protecting the rights of inventors and patentees. Over two hundred and fifty thousand patents have been issued by the United States, from which it is clear that very large interests are at stake in any changes of the patent-laws such as are now pending before Congress. Twenty-eight bills have been introduced in the present Congress, which interfere more or less directly with patents or their owners, and diminish in one way or another the protection afforded to inventors. One bill provides that no damages can be recovered for infringements prior to written notice served on the infringed by the patentee, thus rewarding the secret manufacture of patented articles. Another bill is to prevent the recovery of damages in cases where the amount involved is less than twenty dollars; and another bill fixes this amount at fifty dollars.

— On the 11th of February died John Hutton Balfour, for many years professor of botany in the University of Edinburgh, director of the Royal botanic garden, and Queen's botanist for Scotland. He was born in that city on the 15th of September, 1808, and

had therefore attained a good old age. About four years ago, in failing health, he resigned his official positions, but afterwards recovered his vigor, so that he might have been expected to see his university fairly entered upon its fourth century. The end of this excellent man came suddenly, — we believe, in the same week in which his son, Isaac Bayley Balfour, was elected professor of botany at Oxford. The elder Balfour was eminent only as a teacher of botany, in which he had great success, and in the development and administration of the admirable garden and arboretum of the Scottish capital.

— A "general geologic map of the area explored and mapped by Dr. F. V. Hayden, and the surveys under his charge, 1869 to 1880," forms No. 11. of the series accompanying the twelfth and final report of the geological survey of the territories. This map was not mentioned in our notice of the report (*Science*, No. 51), as it was omitted in the earlier distributed volumes; but it is of especial value in presenting a general review, that is nowhere given in the reports, of what has been accomplished by Dr. Hayden's parties. It includes all of Colorado and Wyoming, the greater part of Montana, and half of Dakota and Nebraska. It has unfortunately no topographic shading; and there is no distinction made in the coloring of those parts that have been examined with satisfactory detail, and others where information is derived from reconnoissance, or even from hearsay. Still, the more notable features of the region are well shown, — the broad monotony of the plains, the inconstant variety of the irregular mountain uplifts, the long-continued paleozoic and mesozoic conformity, and the absence or insignificant representation of the Devonian in the Rocky Mountains proper, and the unconformable overlap of the tertiary. Of more local peculiarity, there may be mentioned the isolated uplift of the Black Hills, here well shown in its relation to the ranges farther west; the abrupt change from a north and south to an east and west trend in the Laramie range; the appearance of narrow and parallel Great Basin ranges at the western margin of Wyoming; and the crescentic form of the Big Horn range. Concerning this last and the more northern part of the map, further exploration may require considerable changes.

— Mr. Paul Bert read to the Paris academy, at a recent meeting, the latest results of his researches into the effects of anaesthetics. He believes that the use of chloroform in surgical cases, where the patient suffers from weakness of the heart, may be made comparatively, if not entirely, safe. Mr. Bert is of opinion that the quantity of an anaesthetic is less important to observe than the tension of the vapor inhaled, and the proportion of air with which it is mixed. He has constructed an apparatus with which he administers a proportion of eight grams of chloroform to a hundred litres of air. Experiments which he has made with this have shown, that not only is a saving of chloroform effected, but the danger is considerably lessened. The pulse of the patient inhaling the mixture is calm, and the temperature of the body is not sensibly lowered; while in only four cases out of twenty-two was the slightest appearance of nausea produced.

To this proposition of Bert's, Gosselin objected that the use of a cumbersome piece of apparatus, in place of the convenient sponge or handkerchief, ought to be considered; and that by Bert's method a uniform amount of chloroform must needs be administered to all patients, regardless of their susceptibility to its effects.

Bert rejoined, that with the sponge there was great danger of exceeding the safe tension of the vapor. His experiments with dogs showed, that, with six grams of chloroform to a hundred litres of air, a dog could be rendered insensible; with ten grams, the insensibility comes on in a few minutes, and can be allowed to continue for an hour and a half with safety; while, with twenty-four grams, the dog was dead in forty-five minutes.

— The petroleum industry of Baku still continues to attract attention. Messrs. Hobel, whose work there has been of such importance to the development of the trade, have published a pamphlet on the capabilities of the province, and the commerce of the Black Sea; while a book is announced in the literary journals, dealing with the working of petroleum since classical times. The title is 'Petrolia;' and it is by Mr. Charles Marvin, of Khiva fame.

— The *Centralblatt für textil industrie* recently published an article on the increase in manufacturing industry in Livonia, Esthonia, Courland, and the Polish provinces of Russia. The first three provinces contain 1,329 factories, the annual production of which now represents a total value of more than £12,000,000, this sum being nearly double the amount for 1873. In Courland the main industry is the distillation of spirits, which in 1882 attained a value of nearly £1,000,000. The development of Polish industry took place, for the most part, during the years 1877–80. In the year 1881 Poland contained 19,000 factories, which produced wares of the total value of about £30,000,000. The greatest progress has been in the textile industries. One factor in the industrial activity of Poland has been the steady demand for yarn from factories in the interior of Russia. The cotton industry is the most important: in 1881 it employed about 20,000 work-people, its out-turn representing a value of £5,000,000. Next comes the woollen industry, with 15,000 work-people, and a yearly production of £3,500,000 in value. In the linen branch 10,000 work-people are engaged, and the production represents about £1,000,000 per annum. The raw material is, for the most part, obtained from the interior of Russia, only a small quantity being imported. Moscow, Charkoff, and St. Petersburg are the principal markets.

— The *Engineer* states that the world's average product of sulphur is about 280,000 tons, of an average value of 109.20 lire per ton = 30,793,000 lire, or over £1,200,000 sterling. Of this total, Sicily produces 242,000 tons. There is an export duty of 11 lire per ton on sulphur, and the average export is 216,000 tons. The Sicilian sulphur is mostly exported raw,

as it comes from the kilns. It is of seven qualities, the values varying from 101 to 115 lire per ton. Except in the better-worked 'solfare,' the separation of the sulphur from the earths in which it is contained is still conducted in Sicily by means of kilns (calcuroni), which do not require any additional fuel, but which entail the consumption and loss of about one-third of the sulphur itself. About 18,000 hands are employed in the Sicilian 'solfare,' of whom about 14,000 work in the interior of the mines, including those employed in the transport of the ore to the surface. The sulphur in many mines is still carried to the surface on the backs of boys called 'carusi,' of whom there are about 3,500.

— Prof. F. H. Snow writes to the *Topeka daily capital* as follows: —

The climate of eastern Kansas is not the climate of western Kansas. Any discussion of this subject will be entirely inadequate which fails to recognize the fact that Kansas is meteorologically divided into two distinct regions, separated from each other by an intermediate area, whose climate exhibits a gradual transition between the eastern and the western sections. The inclusion of two such widely differing regions in one civil commonwealth has its disadvantages as well as its advantages. The striking adaptability of western Kansas to sustain the immense cattle interests of that section adds an important element of prosperity to the state; but the fact that thousands of new-comers, from ignorance of the climate, have attempted to introduce ordinary agricultural operations upon the so-called 'plains,' and have disastrously failed in the attempt, has placed an undeserved stigma upon the good name of Kansas in many far distant communities, and has undoubtedly somewhat retarded immigration during the past few years. It is time for the general recognition of the fact, that, except in the exceedingly limited area where irrigation is possible, the western third of Kansas is beyond the limit of successful agriculture. Yet this portion of Kansas, upon the basis of one individual to each ten acres, has the capacity to continuously sustain an aggregate of nearly two million head of cattle. The last biennal report of the State board of agriculture represents the total number of cattle in the entire state as less than one and a half millions, which is considerably below the number which might be supported by the western third of the state alone.

The average direction of the winds in eastern Kansas is from the south-west. The average velocity of the wind at Lawrence is a little more than fifteen and a half miles an hour. This is sufficiently high to assist materially the proper ventilation of our houses and our clothing, but does not justify the common expression in other parts of the country, that the Kansan lives in a continual gale. For the sake of comparison, it may be mentioned that the average hourly velocity of the wind in Philadelphia is eleven, at Toronto nine miles, and at Liverpool thirteen miles. The greatest velocity recorded at Lawrence was at the rate of eighty miles per hour, from 3.35 to 3.45 A.M., April 18, 1880. The average annual distance travelled by the wind at Lawrence is a little more than a hundred and thirty-eight thousand miles. March and April are the two windiest months, the velocity rising to nearly twenty miles an hour. July and August are the two calmest months, the rate subsiding to less than twelve miles an hour.

— The *Canadian naturalist*, which was discontinued last June, has re-appeared as the *Canadian record of natural history and geology*, published by the natural history society of Montreal. The former journal was published for the society by Messrs. Dawson Brothers. We regret the unnecessary change of title, when the scope of the journal is precisely the same as before, and it remains the organ of the same society.

— The belief of the Hawaiians, that the Achatinellae emit musical sounds, is an old one; and these pretty little mollusks were sometimes called 'singing-snails.' The Rev. H. G. Barnacle, M.A., of the Transit of Venus expedition in 1874, heard the music, which he compares to the sound of many aeolian harps. Hitherto the native story has not found credence among conchologists; but this gentleman succeeded in determining that the sound was due to the friction of the shells upon the bark of the trees, over which they are dragged by their inhabitants. As most of the species are arboreal, and they exist in millions, it is conceivable that the sound should be distinctly audible; yet that it should be in any way musical is singular.

— Miss Fannie M. Hele has recently observed the effect of food on a lemon-colored variety of Helix aspersa. A diet of lettuce reduced them to a dirty-brown yellow; and the more lettuce given to them, the darker and dingier the color of the shell became. A reversed specimen was bred from, in the hope of securing additional specimens of this rare variety; but to no purpose: the eggs, when hatched, produced only normal individuals.

— During the past year, four new additions were made to the group of small planets between Mars and Jupiter, making the number two hundred and thirty-five in all. No. 232, named Russia, was discovered the 31st of January, 1883, by Palisa, at Vienna: its magnitude is the twelfth, and the elements of its orbit exhibit no peculiarities. No. 233, not yet named, was discovered by Borelly, at Marseilles: its magnitude is the eleventh, and the elements of its orbit are as yet undetermined. No. 234, named Barbara, was discovered the 12th of August, 1883, by Peters, at Clinton: its magnitude is the ninth, and the elements of its orbit exhibit no peculiarities. No. 235, named Carolina, was discovered the 21st of November, 1883, by Palisa, at Vienna: its magnitude is the twelfth, and the elements of its orbit are as yet undetermined. The twelve small planets immediately preceding the above have received names as follows: —

220, Stephania.	224, Oceana.	228, Agathe.
221, Eos.	225, Henrietta.	229, Adelinda.
222, Lucia.	226, Weringia.	230, Athamantis.
223, Rosa.	227, Philosophia.	231, Vindobona.